DAMAGE STABILITY SYSTEM

For The

SHIP HULL CHARACTERISTIC PROGRAM

Prepared For

UNITED STATES COAST GUARD
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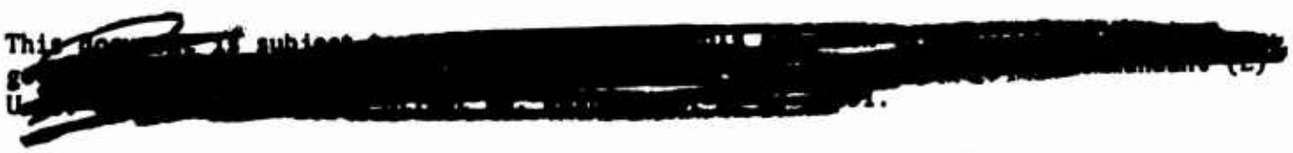

May 1967

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DAMAGE STABILITY SYSTEM FOR THE SHIP HULL CHARACTERISTICS PROGRAM

I. GENERAL

The Damage Stability system for the Ship Hull Characteristics Program (SHCP) consists of two major supervisor programs;

A. Subroutine CMPRTMNT

This program supervises the generation of compartment offsets for compartment bulkheads and all intermediate ship stations that lie within the bounds of the compartment, based on an outline description of each bulkhead. A Compartment Data Table (CDT), similar in form to the Ship Data Table (SDT), of offsets, sectional areas, centers of area, and breakpoint, is then created and stored on the Ship Data Tape (SDTPE) for later recall by Subroutine DAMAGE.

B. Subroutine DAMAGE

This program supervises the calculation of damage stability characteristics of the ship minus selected flooded compartments for a range of draft, trim, and heel conditions. The sequence of events for each condition of compartments, draft, trim, and heel is as follows:

1. The SDT is read from the SDTPE.

2. The volumetric properties of the intact ship are calculated.

3. For each selected compartment, the associated CDT is read from the SDTPE and the volumetric properties of the compartment are calculated and stored.

4. The net volumetric properties and the righting arm for the ship minus compartments, i.e., the flooded condition, is computed and output for the condition is printed out.

The Compartment Data Tables may be created by use of Subroutine CMPRTMNT or by submitting compartment offsets in the same manner of submission as ship offsets for the Ship Data Table. If the compartments are submitted by the latter method, the LBP card must contain the Length of the Ship, and the stations must be in terms of ship stations.

C. Program Identification Numbers for calling by the Executive Routine

CMPRTMNT.....	007
DAMAGE.....	008

II. Subroutine CMPRTMNT

A. Execution Time: 50 seconds/compartment, maximum

B. Input:

1. Ship Data Table (on tape)

2. Card Types 1, 2, 6: see NAVSEC documentation of the EXECutive Program for description of card types 1, 2, 6, E, which are always required. NAVSHIPS 0900-006-5600.

3. Card Type 25: Number of compartments; Format-I5; NCOMP1

For each compartment

4. Card Type 26: Compartment serial number, compartment name, date, symmetry sentinal, number of bulkheads in the compartment; Format-I4, 10A4, 6X, 2I3; ISERNO, NAME IS, DATE, IISYM, NBULK. Symmetry sentinal definitions: 000, compartment on, or flooded on, both sides of the centerline; b-1, compartment on, or flooded on, the port side only; b+1 compartment on, or flooded on, the starboard side only. (b represents blank)

For each bulkhead

5. Card Type 27: Number of outline points on the bulkhead, distance of bulkhead from FP 9 (in feet); Format-I5, F10.2; NINT(I), XBLK(I)

For each outline point

6. Card Type 28: Z of outline point, Y of outline point; Format-2F10.2; ZINT(I, IPT), YINT (I, IPT)

C. Sample Input

2 compartments, 2 bulkheads each, 3 outline points on 1st bulkhead of each compartment, 4 outline points on 2nd bulkhead of each compartment;

Card deck by card type number: 1,2,6,25,26,27,28,28,28,27,28,28,28,28
26,27,28,28,28,27,28,28,28,28,E

III Subroutine DAMAGE

A. Execution Time: (1 + number of compartments in set) x 5 x number of drafts x number of heels x number of trims.

time is in seconds for a set of compartments

B. Input:

1. Ship Data Table and Compartment Data Tables (on SDTPE)

2. Card Types 1,2,6; see NAVSEC documentation of EXECUTIVE routine for description of card types 1,2,6 which are always required. NAVSHIPS 0900-006-5600

3. Card Type 29: Number of sets of compartments (maximum:20); Format- I5; NSET

For each compartment set

4. Card Type 30: Number of compartments in set (maximum:25); Format- I4; L1COMP(I)

5. Card Type 31: List of serial numbers of compartments in set I and associated permeabilities (10 Compartments per card); Format- 10(I4,F4.2); L2COMP(I,J), PERM8(I,J)

6. Card Type 32: Number of trims, number of drafts, number of heels (maximum:3,8,10); Format - 3I5; N4TRIM, N4DRFT, N4HEEL

7. Card Type 33: Input trim angles in degrees (one per card); Format - F10.3; D1TRIM

8. Card Type 34: Input drafts in feet above baseline (one per card); Format - F10.3; D1DRFT

9. Card Type 35: Input heel angles in degrees (one per card); Format - F10.3; D1HEEL

C. Sample Input

Two sets of compartments, the first set with less than 10 compartments, the second set with more than 10, 5 drafts, no trims and 6 heels;

Card deck by card type number: 1,2,6,29,30,31,31,30,31,32,34,34,
34,34,35,35,35,35,35,E

NOTE: There is no Card Type 33 because no trims were submitted. In this case a trim of zero is assumed and submission of Card Type 33 is not required.

The Damage Stability Computer Programs described herein are for incorporation into the Ship Hull Characteristics Program developed by Mr. G. E. Hirschberg and Lt. R. L. Warters at the Naval Ship Engineering Center, Washington, D. C.

For documentation of those programs not part of the Damage Stability System, the reader should see the documentation produced by NavSec:

NavShips Number 0900-06-	TITLE
5600	EXECUTIVE
5610	AREAS
5620	BAL
5630	COEF1C
5640	COEF1I
5650	DRAFT
5670	FNTP1F, FNTP2F, FNTG1F, TRANSF, & TESTS
5690	FLNGTH
5700	HYDRO
5710	HILIM
5720	OFFSET
5730	STRNTH
5740	TABLE
5750	TEST1
5760	TEST2
5770	VOLUME
5790	WAVE
5800	WPLANE
5810	WPLAN1
5820	WETSRF
5830	INTACT

DOUBLE OFFSET MODIFICATION

I. Modification Description:

The modifications described herein permits YGHULL to handle all conceivable hull forms with the exception of the trimaran for all of the major supervisors within the program system.

The major modification to the program exists in Subroutine AREAS. Except for housekeeping changes such as changes in the DIMENSION and COMMON Statements and limits of some DO Loops the system remains unchanged.

If the hull form is such that double offsets exist over some portion of the entire length - the catamaran hull form and a well are examples - the hull is submitted to the program in two parts. One "hull" is the offsets of the outer portion of the hull. The second "hull" consists of offsets of the inboard portion of the hull. See Figure 1. The Subroutine AREAS then subtracts the properties of the "inner hull" from the "outer hull" to get the properties of the actual ship hull form. The properties of the section are then returned to Subroutine VOLUME and the system then proceeds normally.

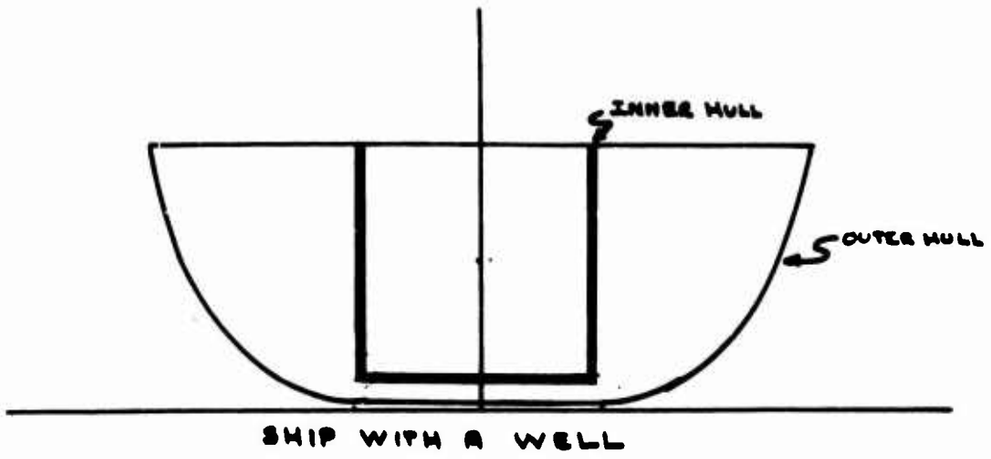
The basic operation of AREAS is now as follows:

The program proceeds through AREAS normally to the point just before returning to the calling program which is Statement 1307. At that point the new variable ICAT is interrogated to see if it is equal to one, two or three. If ICAT is one, then AREAS assumes a normal ship and returns to the calling program. If ICAT is two, AREAS assumes a "dual hull" form and stores the properties computed so far in temporary accumulators. These are the properties of the "outer hull". The variable ICAT is then set equal to three and the station indicator ISTAT is increased by NSTAT, the number of stations in one hull. The change in the index ISTAT is based on the premise that that two "hulls" are submitted in sequential order with the "outer hull" being first, the "inner hull" being second and each hull having the same number of stations located at the same place along the longitudinal axis. The program then makes another pass through AREAS and computes the properties of the "inner hull".

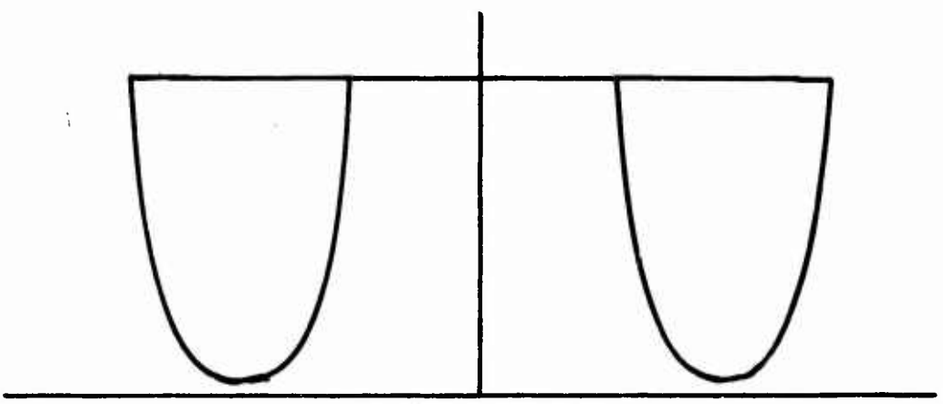
This time when the program gets to the test of the variable ICAT following Statement 1307 the value of this variable is three (3). The program then branches to Statement 799 where the net properties of the section are computed. ICAT is reset to two and ISTAT is reset to its original value. Control then returns to the calling program with properties of the net sections stored in the work table.

II Input:

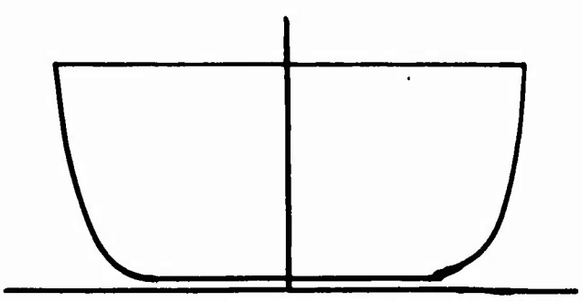
Each hull" is submitted in accordance with standard procedures, the last point on the last station of each hull having a breakpoint indicator value of 99999.



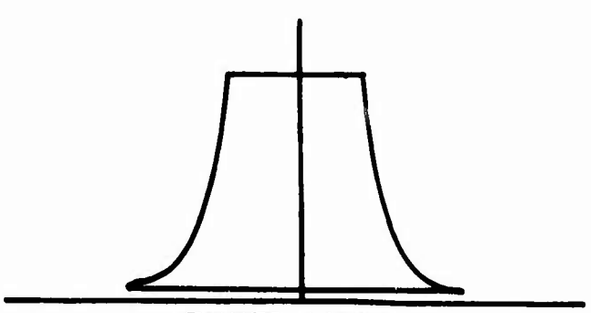
SHIP WITH A WELL



CATAMARAN



OUTER HULL



INNER HULL

FIGURE 1

DOUBLE OFFSET MODIFICATION (continued)

Each "hull" must have data submitted at the same stations. If there is no inner hull at a station - in the case of a well on inner hull exists only in way of the well - a data card must still be submitted for that station, the Y and Z values being zero with a breakpoint indicator value of 88888 or 99999 if it is the last station.

On any given station, the data points on the inner hull may be independent of the data points on the outer hull.

The outer hull is submitted first, the inner hull follows, and the LBP card is last.

Card Type 1: The number 002 should be punched in cc. 51-53 if two hulls are being submitted; 000 for a regular hull.

LONGITUDINAL BREAKPOINT MODIFICATION

1 Modification Description:

The standard version of the Ships Hull Characteristics Program performs longitudinal integration from the first station to the last station by integrating groups of 3 consecutive stations according to Simpson's first rule (1, 4, 1) and summing the results. If there are an even number of stations, or if the middle station in a group of 3 does not lie half way between the first and third, interpolation is performed to find the values of the missing, or evenly spaced, station. However, there is no method of taking into account any longitudinal discontinuities in the hull, such as the end of a poop or forecastle deck, or the boundaries of a well (the latter require incorporation of the Double Offset Modification to SHCP). The modification described herein eliminates this restriction.

This is accomplished by submitting twice any station where longitudinal integration should stop, and begin again. For example, in Figure 1 it is desired to stop integration at the end of the sonar dome (and then begin again). Thus, Station 4 should be submitted twice.

Figure 2 illustrates a slightly different case. Here the area of Station 5 is different when integrating aft from Station 1, than when integrating aft from Station 5. Consequently, the first Station 5 submitted will describe the area 5A in Figure 2, and the second Station 5 submitted will describe the area 5B. The program integrates to the first Station 5 encountered (area 5A), and begins again at the second Station 5 (area 5B).

Figure 3 illustrates the use of this feature when using the Double Offset Modification. Here a well begins at Station 6 and ends at Station 8. Thus it is desired to resubmit both of these station twice. They are submitted as illustrated 6A1, 6A2, 6B1, 6B2, 8A1, 8A2, 8B1, 8B2.

Each double station counts as two stations with respect to all arrays. This should be considered when counting total station so as not to exceed the maximum number permitted, which is 30.

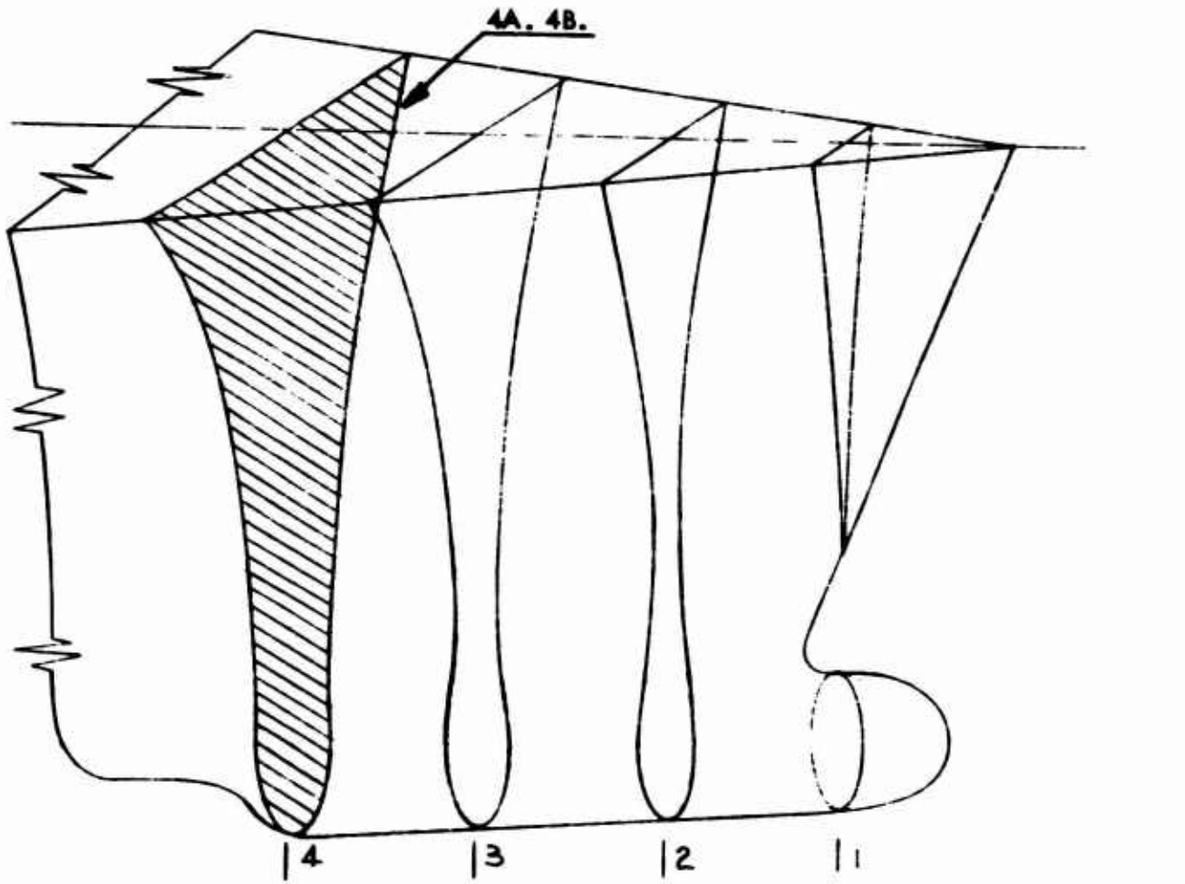


FIGURE 1

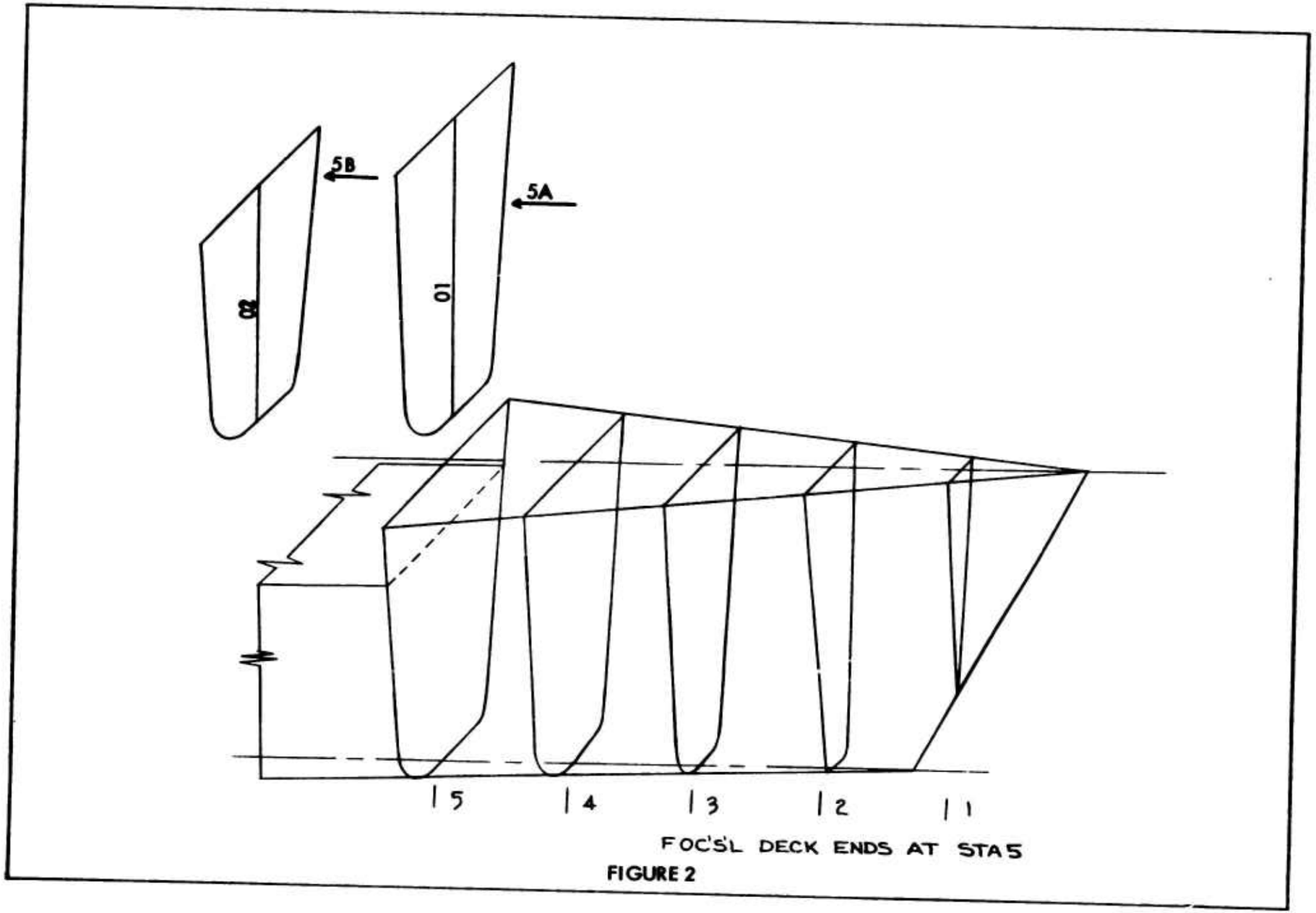


FIGURE 2

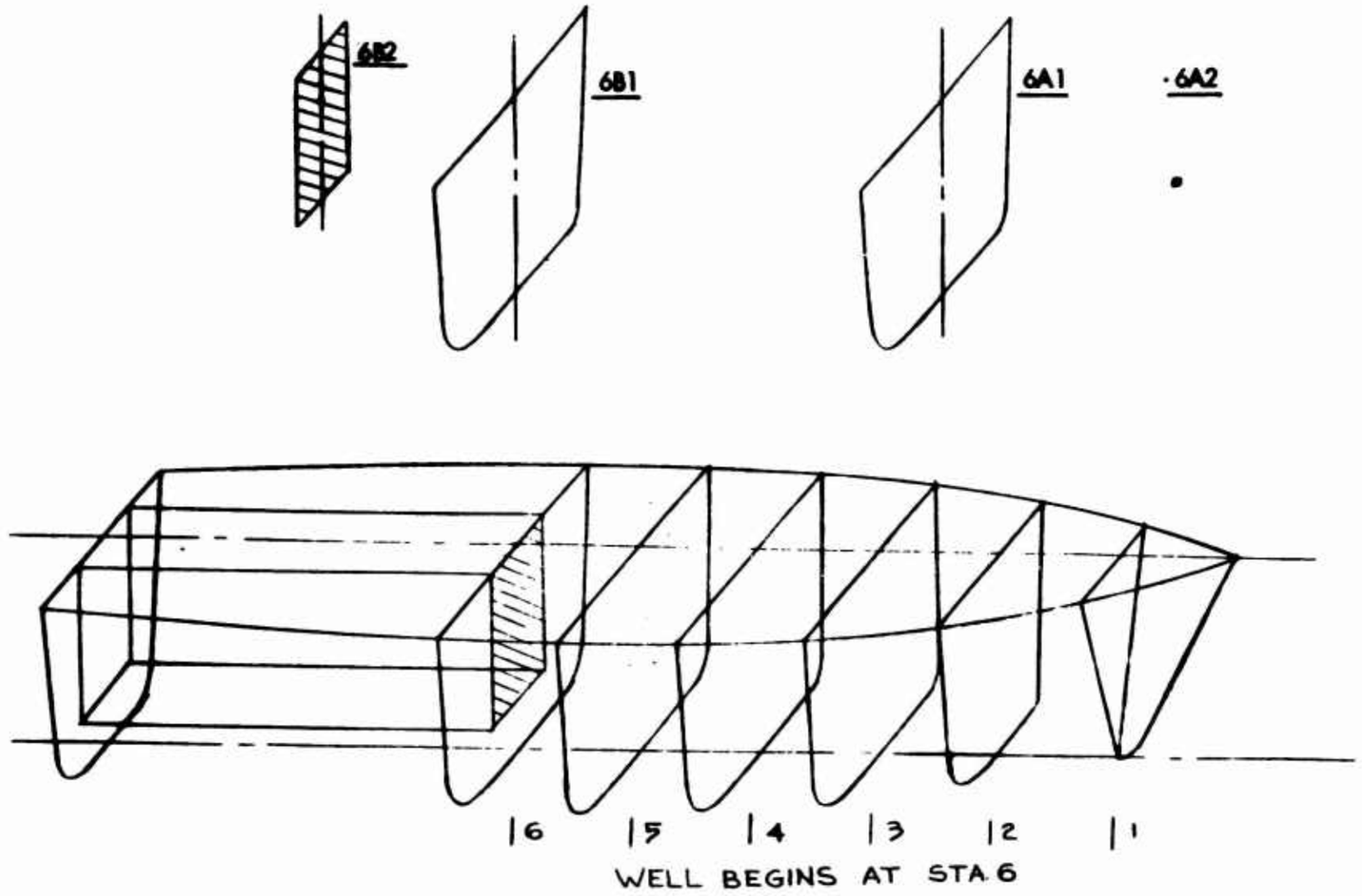


FIGURE 3

SUBROUTINE CMPRTMNT

Description:

This program supervises the generation of compartment offsets for compartment bulkheads and all intermediate ship stations that lie within the bounds of the compartment, based on an outline description of each bulkhead.

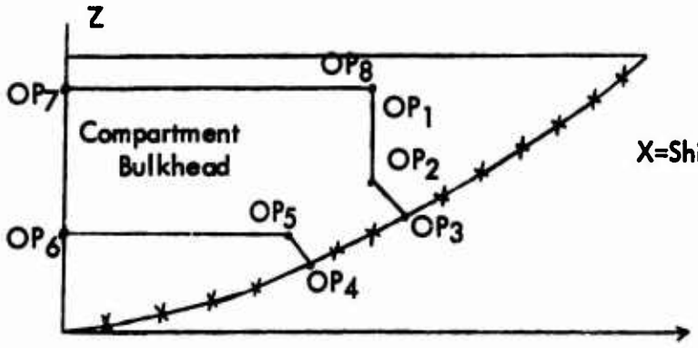
The basic operation of the program for each compartment is as follows:

1. The Ship Data Table (SDT) is read from the Ship Data Tape (SDTPE).
2. The compartment title card is read.
3. The outline point description for all bulkheads are read.
4. The outline point description of each bulkhead is tested to determine if a double hull is required for the compartment.
5. Subroutine GENERATE is called which generates the compartment offsets.
6. The compartment offsets are transferred to the ship offset arrays.
7. Subroutine OFFSET is called where the SDT for the compartment is created and stored on the SDTPE.

BULKHEAD OUTLINE DEFINITION POINTS

Each bulkhead is described by a series of Z and Y coordinates which defines the outline of the bulkhead section with reference to the ship section and the ships YZ coordinate system. These points shall be referred to hereafter as "outline points" or "OP's."

Outline points exist wherever there is a discontinuity in the section outline, such as the intersection of a longitudinal bulkhead with a deck or the hull. Figure 1 illustrates the definition of outline points.



X=Ship data table points.

FIGURE 1

It should be noted that the half section of the bulkhead is defined, the bulkhead being assumed to be a symetrical about the centerline. The value of the input variable 11SYM on the Compartment Title Card indicates which side of the centerline or both that the compartment lies on.

The northeast most point of the bulkhead is OP #1. Successive OP's are taken at each discontinuity in the outline proceding in a clockwise direction. The last OP, #8 in Figure 1, is identical to OP #1.

There are four basic types of OP's:

1. Z = value, Y = value; describes an OP occurring entirely with the ship section. (OPs #1, 2, 5, 6, 7 in Figure 1)

2. Z = value, Y = 9999; describes an OP defining an intersection with the hull surface (OPs #3, 4 in Figure 2)

3. Z = 9999, Y = value or 9999; describes an OP existing at the top of the ship section (Figure 2, OPs 1, 3, 4)

4. Z = -9999, Y = value 9999, describes an OP existing at the bottom of the ship section. (Figure 2, OP #2)

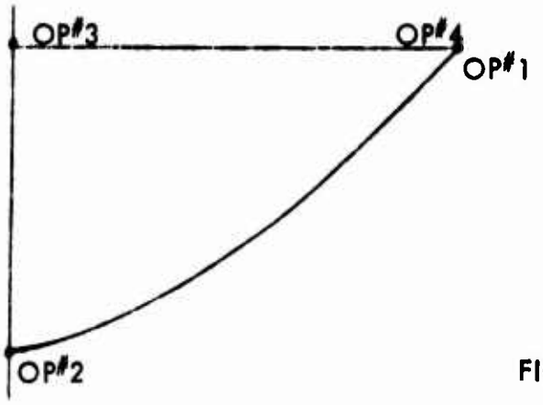


FIGURE 2

Use of these four OP types must be strictly adhered to within the above definitions. Violations of these rules will produce errors in the bulkhead section definition.

Figures 3 thru 6 further illustrate the use of the four OP types with a single hull vessel.

The use of the four OP types is identical with a double hull vessel. Care should be taken that all OP values are defined with respect to the centerline of the ship not of the individual hull. In other words, use the same coordinate system used to originally describe the ship.

Figures 7 thru 11 illustrate principles of use with double hulls.

OP	Z	Y
1	$Value_1$	$Value_1$
2	$Value_2$	$Value_2$
3	$Value_3$	9999
4	$Value_4$	9999
5	$Value_5$	$Value_5$
6	$Value_6$	0
7	$Value_7$	0
8	$Value_{8=1}$	$Value_{8=1}$

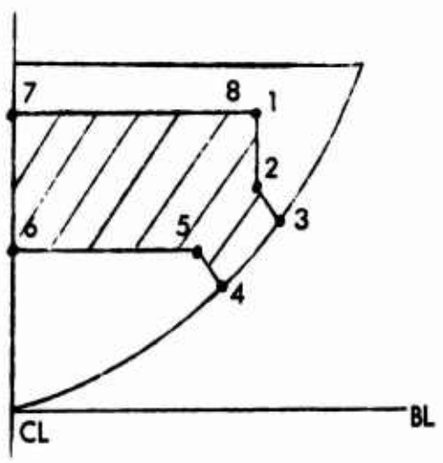


FIGURE 3

BULKHEAD OUTLINE DEFINITION POINTS (continued)

OP	Z	Y
1	9999	$Value_1$
2	$Value_2$	9999
3	-9999	0
4	9999	0
5	9999	$Value_{5=1}$

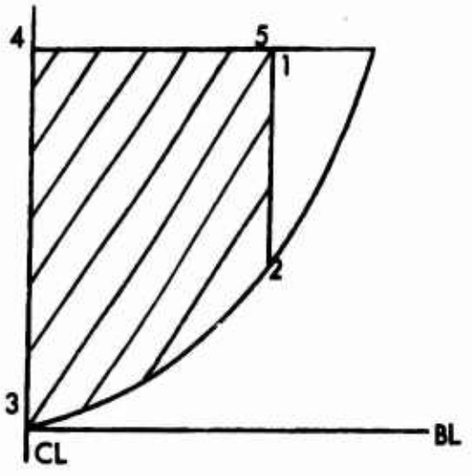


FIGURE 4

OP	Z	Y
1	9999	9999
2	-9999	0
3	9999	0
4	9999	9999

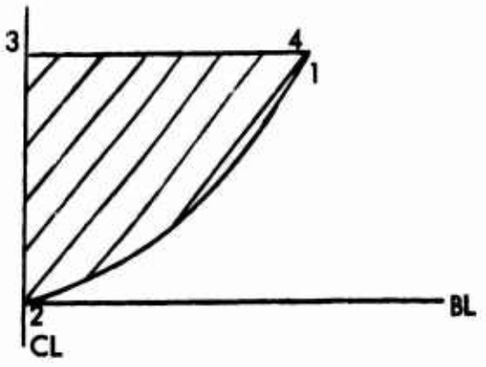


FIGURE 5

OP	Z	Y
1	$Value_1$	9999
2	$Value_2$	9999
3	$Value_3$	Value
4	$Value_4$	Value
5	$Value_{5=1}$	9999

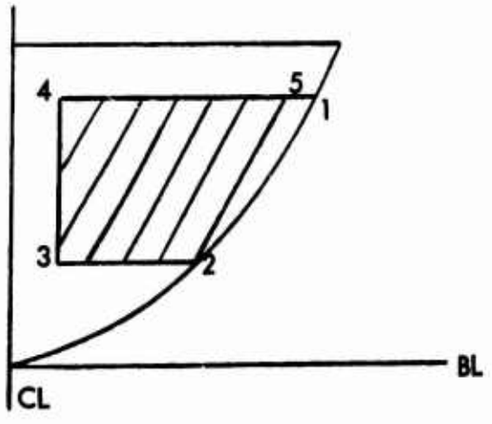
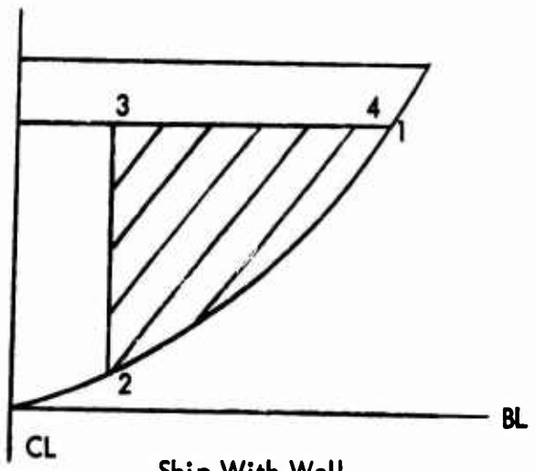


FIGURE 6

BULKHEAD OUTLINE DEFINITION POINTS (continued)

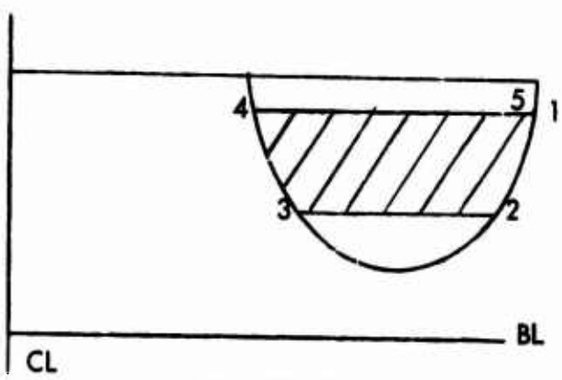
OP	Z	Y
1	$Value_1$	9999
2	-9999	$Value_2$
3	$Value_3$	$Value_3$
4	$Value_{4=1}$	9999



Ship With Well

FIGURE 7

OP	Z	Y
1	$Value_1$	9999
2	$Value_2$	9999
3	$Value_3$	9999
4	$Value_4$	9999
5	$Value_5$	9999



CATAMARAN

FIGURE 8

OP	Z	Y
1	9999	9999
2	-9999	9999
3	9999	9999
4	9999	9999

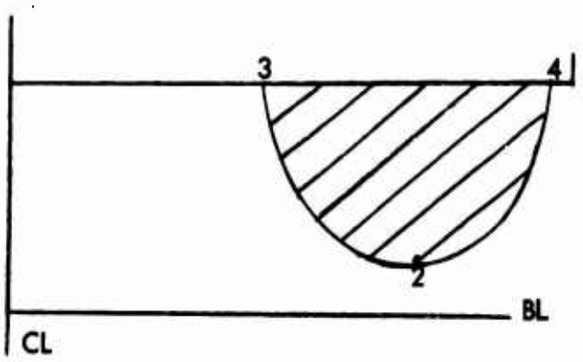


FIGURE 9

NOTE: OP 2 is always required - i.e. lowest point on hull.

BULKHEAD OUTLINE DEFINITION (continued)

OP	Z	Y
1	9999	$Value_1$
2	$Value_2$	9999
3	$Value_3$	9999
4	9999	$Value_4$
5	9999	$Value_{5=1}$

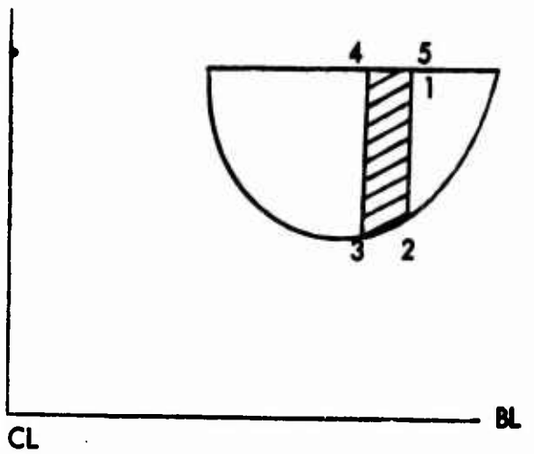


FIGURE 10

OP		
1	9999	$Value_1$
2	$Value_2$	9999
3	$Value_3$	9999
4	9999	$Value_4$
5	9999	$Value_{5=1}$

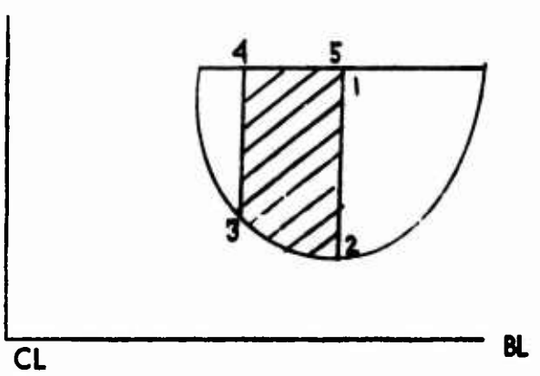
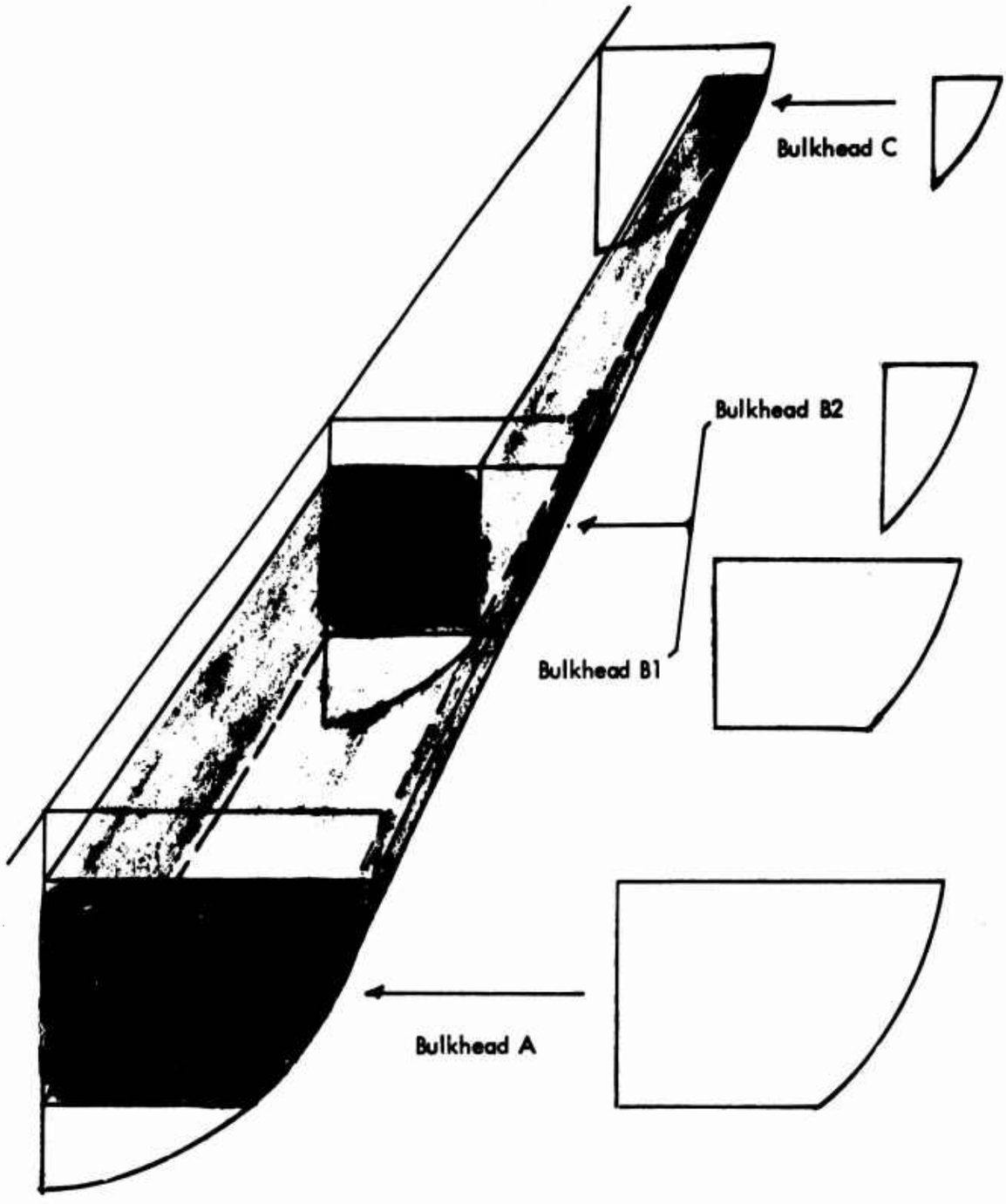


FIGURE 11

NOTE: The OP definition of Figures 10 and 11 are identical, even though in the former case the hull surface used is the "outer ship hull" and in the latter case it is the "inner ship hull." The program determines which ship hull to use by the following logic: OPs are taken clockwise from the NE point; therefore, if ΔZ between the first OP that is a hull intersection and the following OP which must also be a hull intersection, that is $Z_3 - Z_2$, is negative, the ship hull must be the outer one; if ΔZ is positive, it must be the inner one. This follows from the definition of ship outer and inner hulls- the outer hull being that portion of the hull surfact lying outboard of the lowest point; the inner hull being that portion of the hull surfact lying inboard of the lowest point.

COMPARTMENT DEFINITION



COMPARTMENT DEFINITION (continued)

Four "bulkheads" are required to describe the compartment illustrated on the previous page. Bulkheads A and C are obvious. At B two "bulkheads" are submitted, B1 and B2, to alter the cross section of the compartment. These "bulkheads" have the same longitudinal location in the ship and are consequently treated as a double station. Thus, in integrating between A and B, the B1 cross section is used; in integrating between B and C, the B2 cross section is used.

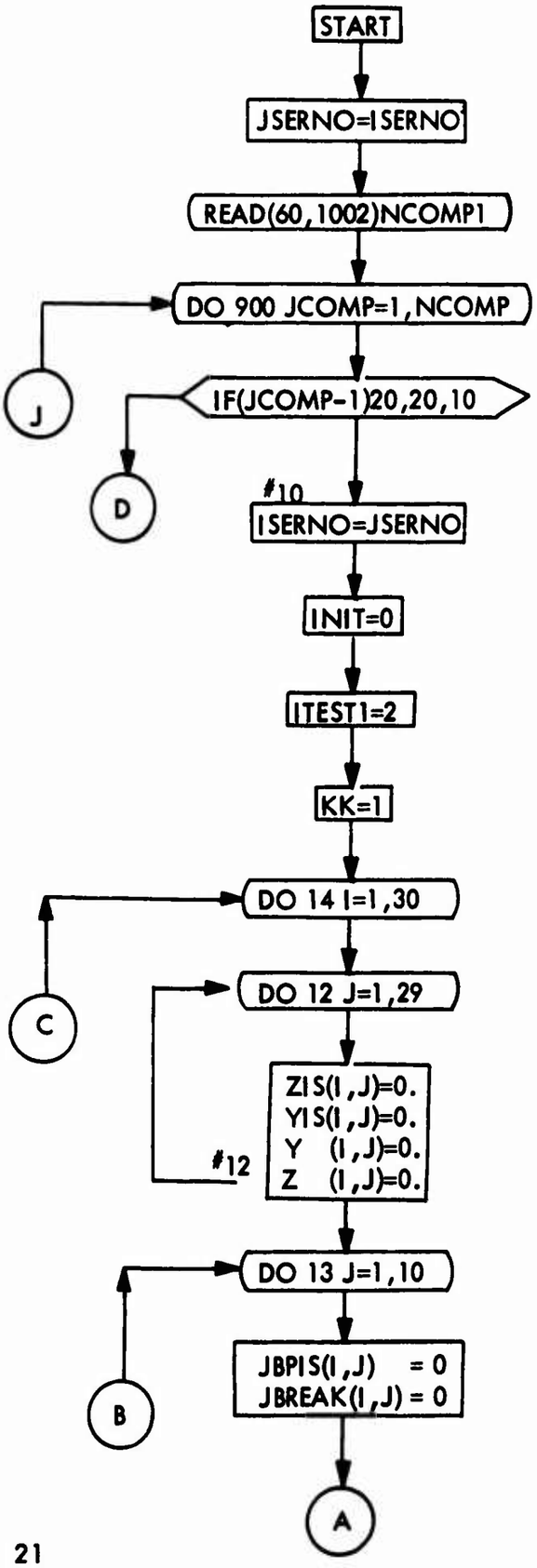
The illustrated compartment may be described as one "compartment", i.e. from A-C, only when the entire run from A-C exists on both sides of the centerline, or on either side. If the symmetry of the compartment from A-B is not the same as that from A-C, i.e. A-B exists on both sides of the centerline but B-C exists only on one, the compartment must be submitted in 2 parts, or as 2 separate compartments. When executing the Damage Stability Program, it would then be necessary to call both compartments, even though they are physically one. The sentinel 11SYM on the compartment title card describes the compartment symmetry: 0 = both sides of centerline; + = starboard side only; - = port side only. The following table delineates all possible combinations for the illustrated compartment.

COMPARTMENT DEFINITION (continued)

COMPARTMENT DESCRIPTION			COMPARTMENT LOCATION			
Number of Compartments	Compartment run	11 SYM	A-B Stbd	A-B Port	B-C Stbd	B-C Port
1	A-C	0	X	X	X	X
1	A-C	-1		X		X
1	A-C	+1	X		X	
2	A-B B-C	0 +1	X	X	X	
2	A-B B-C	0 -1	X	X		X
2	A-B B-C	+1 0	X		X	X
2	A-B B-C	-1 0		X	X	X

SUBROUTINE CMPRTMNT

FLOWCHART



NOTE: SDT: Ship Data Table
SDTPE: Ship Data Tape

Store ship serial number.

Read number of compartments.

Do for each compartment.

IF JCOMP=1 ship data table has already been read in EXEC; GO TO 20.

ISERNO=ship serial number.

SDTPE exists (for OFFSET).

Ship is on SDTPE (for OFFSET).

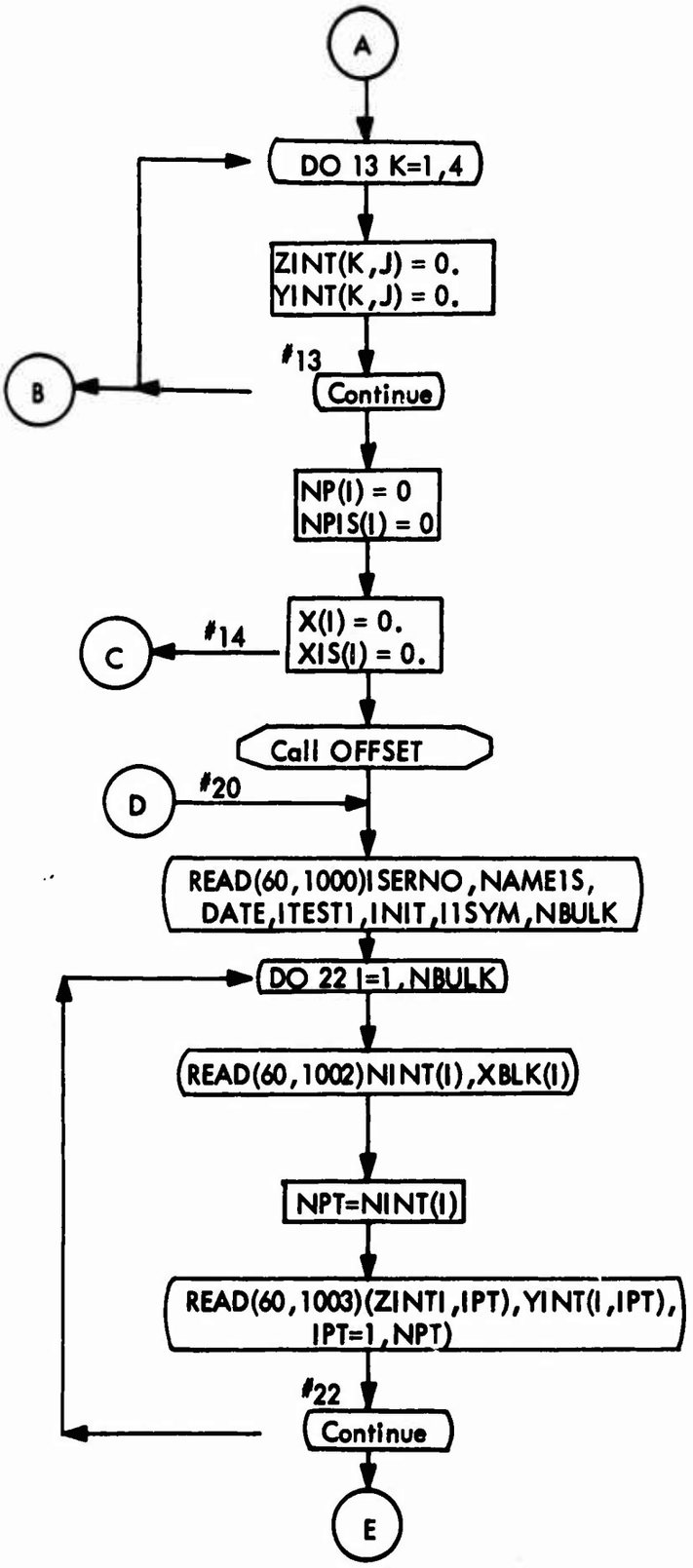
Do not print out SDT (for OFFSET).

Clear ship and compartment offset arrays to zero.

Clear Ship and compartment breakpoint tables to zero.

SUBROUTINE CMPRTMNT

FLOWCHART (continued)



Clear compartment outline point arrays to zero.

Clear ship and compartment number of points/station tables to zero.

Clear ship and compartment "station distance from FP" arrays to zero.

Subroutine OFFSET read SDT of ship from SDTPE.

Read compartment title card.

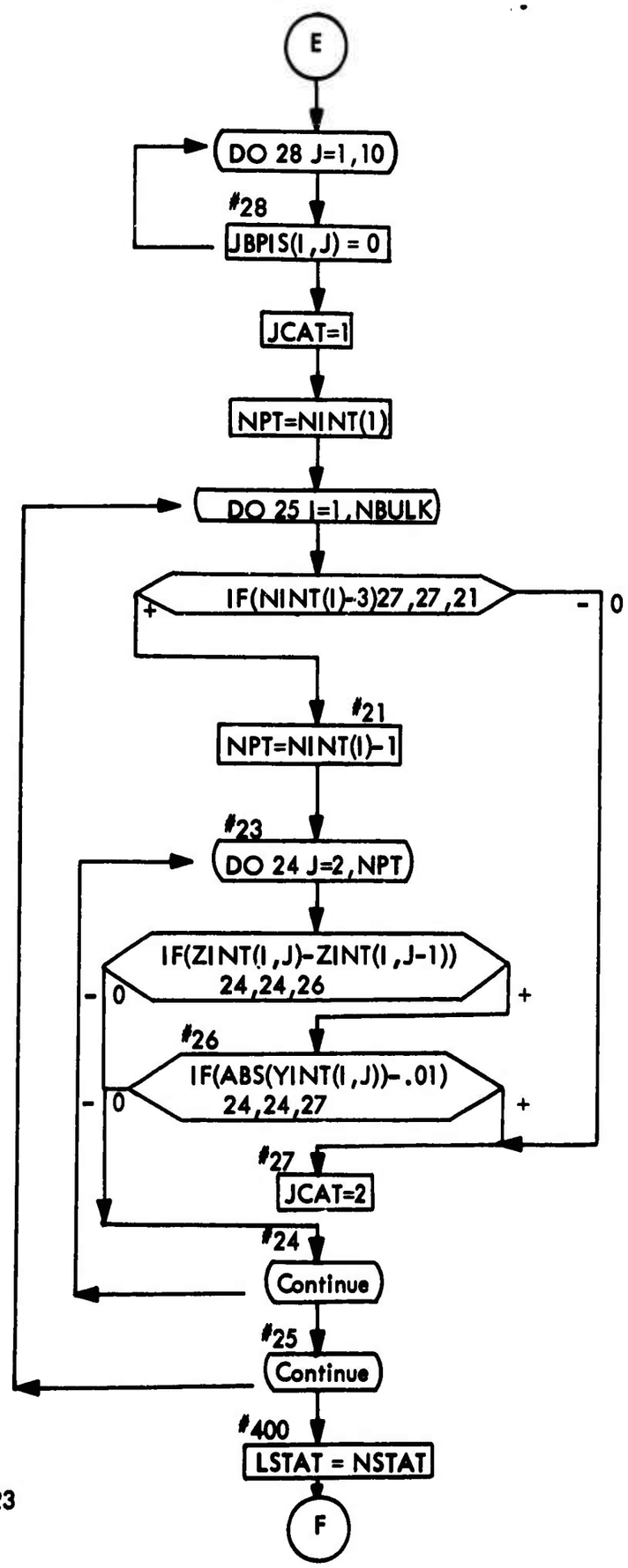
Do for each bulkhead.

Read number of outline points on bulkhead and distance of bulkhead from FP.

Number of outline points on bulkhead.

Read in outline points.

SUBROUTINE CMPRTMNT



FLOWCHART (continued)

Clear compartment breakpoint table to zero.

Assume compartment has single hull.

Number of outline points on first bulkhead.

Test to determine if compartment has double hull. Test each bulkhead.

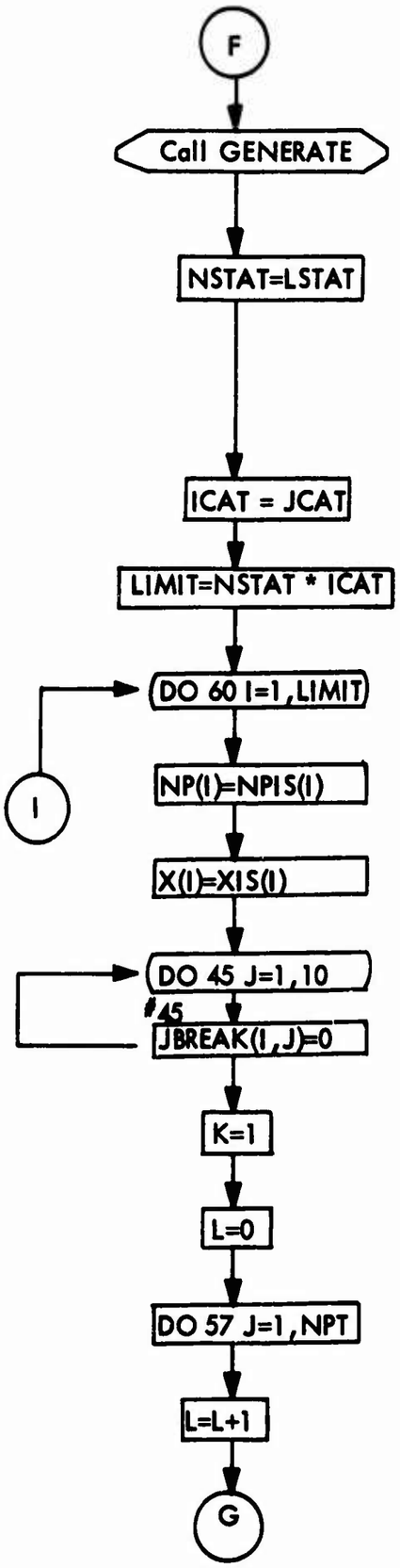
If the number of points on the bulkhead is equal to 3, the compartment must have a double hull (See Notes #1).

Otherwise, do not consider last outline point as it is the same as the first outline point.

Test Δ Z between successive outline points. When Δ Z becomes positive test the Y value of the outline point. If Y is zero the point lies on the ship centerline, which does not require a double hull; go on to next outline point. If Y is positive a double hull will be required; reset JCAT to 2. If any one bulkhead requires a double hull, so will the compartment as a whole. Go on to 400.

Assume number of stations in compartment equals the number of ship stations.

SUBROUTINE CMPRTMNT



FLOWCHART (continued)

Subroutine GENERATE creates the table of compartment offsets and stores them in the IS arrays.

The following statements transfer the compartment data to the ship tables. The compartment thus becomes a "ship". Number of stations in "ship" equals the number of stations in the compartment.

Single/double hull indicator.

Array size for stations.

Do for each station.

Number of points/station.

Distance of station from FP.

Clear ship breakpoint table to zero.

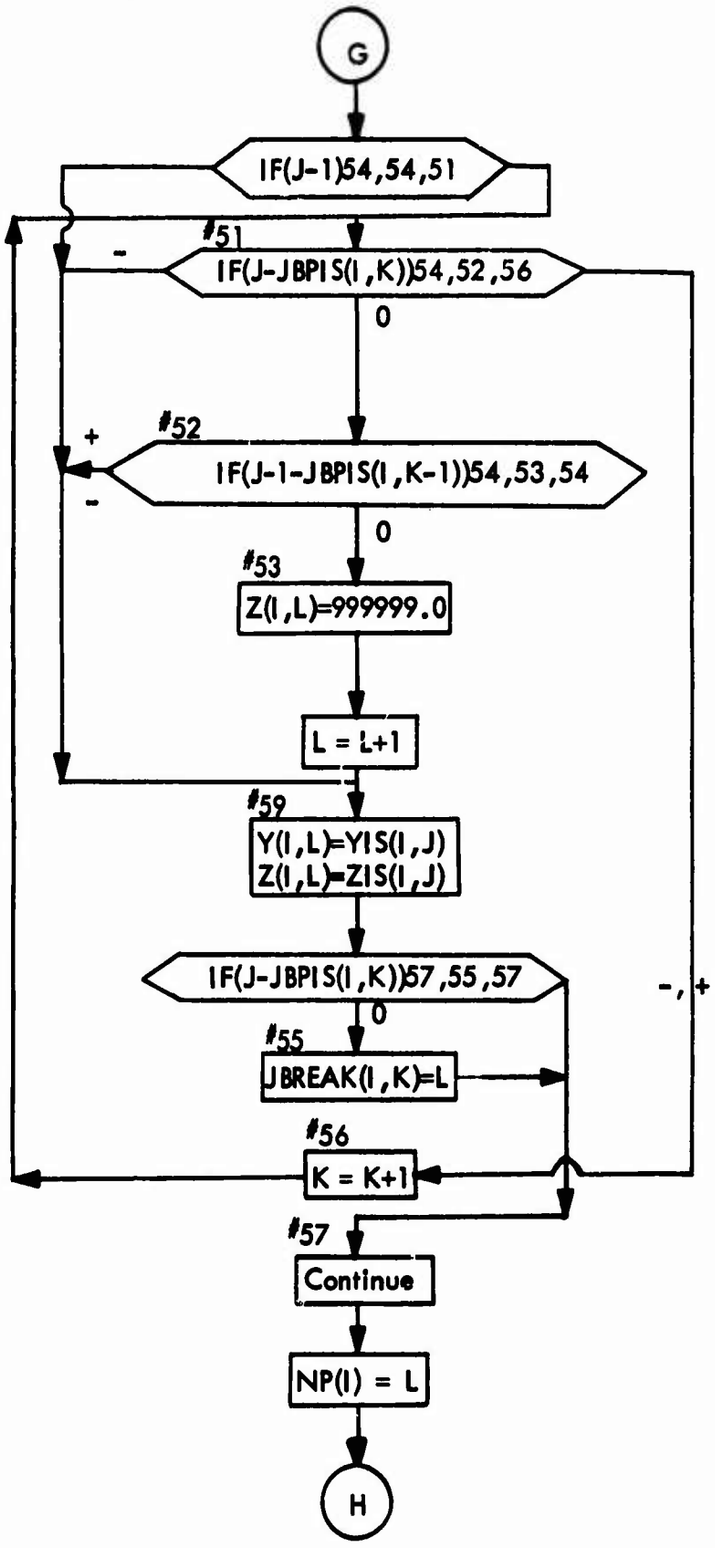
K=index of compartment breakpoint table.

L=index of ship offset table.

J-index of compartment offset table (do for each offset).

Increase index of ship offset table by 1.

SUBROUTINE CMPRTMNT



FLOWCHART (continued)

If this is first offset go right to transfer area (#54).

If the index of the offset is less than the next breakpoint, go to transfer area (#54). If the index is greater, increase the breakpoint index (#56).

If the index is equal to that of the next breakpoint, test to see if the previous point was also a breakpoint If it was not, go to transfer area (#54). If it was, two successive breakpoints have occurred, and a space in the table must be left for insertion of an intermediate point. Insert the signal value of Z=999999.0 and increase the "ship" offset table, L, by 1.

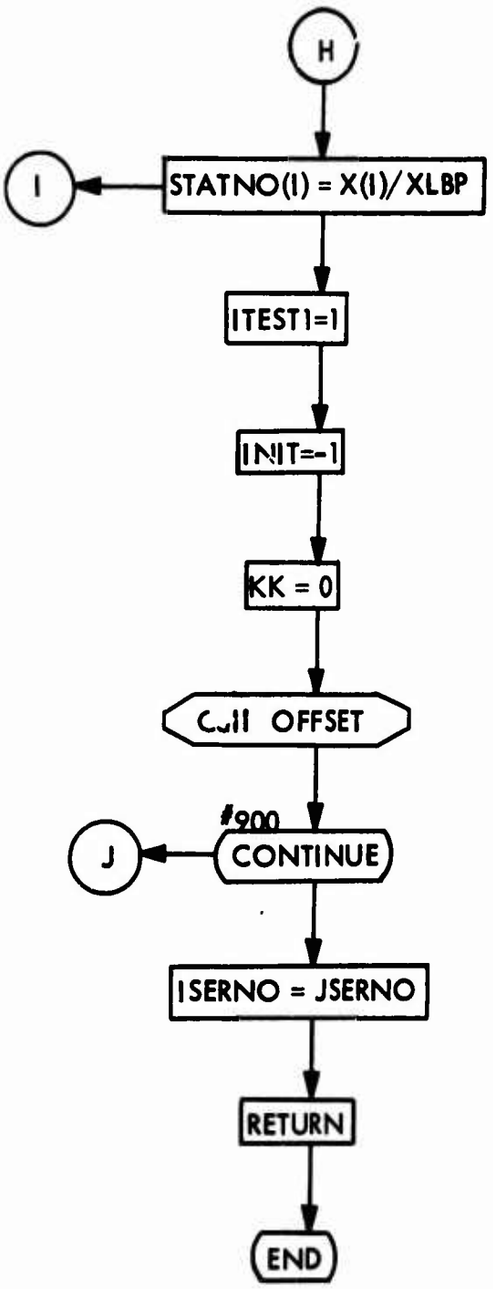
Transfer the offset in the compartment table to the ship table.

If this offset was a breakpoint, store the index in the "ship" breakpoint table. Go on to next offset

Increase index of compartment breakpoint table by 1.

Number of points on station = final value of L.

SUBROUTINE CMPRTMNT



FLOWCHART (continued)

Station number of compartment stations expressed as a % of LBP.

Put "ship" on tape (for OFFSET).

For OFFSET.

Print out "ship" data table (for OFFSET).

Create SDT for compartment and write on SDTPE, also print SDT.

Restore ship serial number.

Return to EXEC(YGHULL).

SUBROUTINE GENERATE

Program Description:

GENERATE supervises the formulation of offset tables for the compartment based upon the general bulkhead descriptions and the ships offsets as delineated in the Ship Data Table (SDT).

The operation is basically a merge of bulkheads and intermediate ship stations contained in the SDT into a table giving a full description of the compartment. This manipulation involves three basic sets of arrays:

1. Bulkhead arrays.
   XBLK( ) The distance of each bulkhead from the F.P.
   ZINT(,) The Z value of the bulkhead outline points.
   YINT(,) The Y value of the bulkhead outline points.

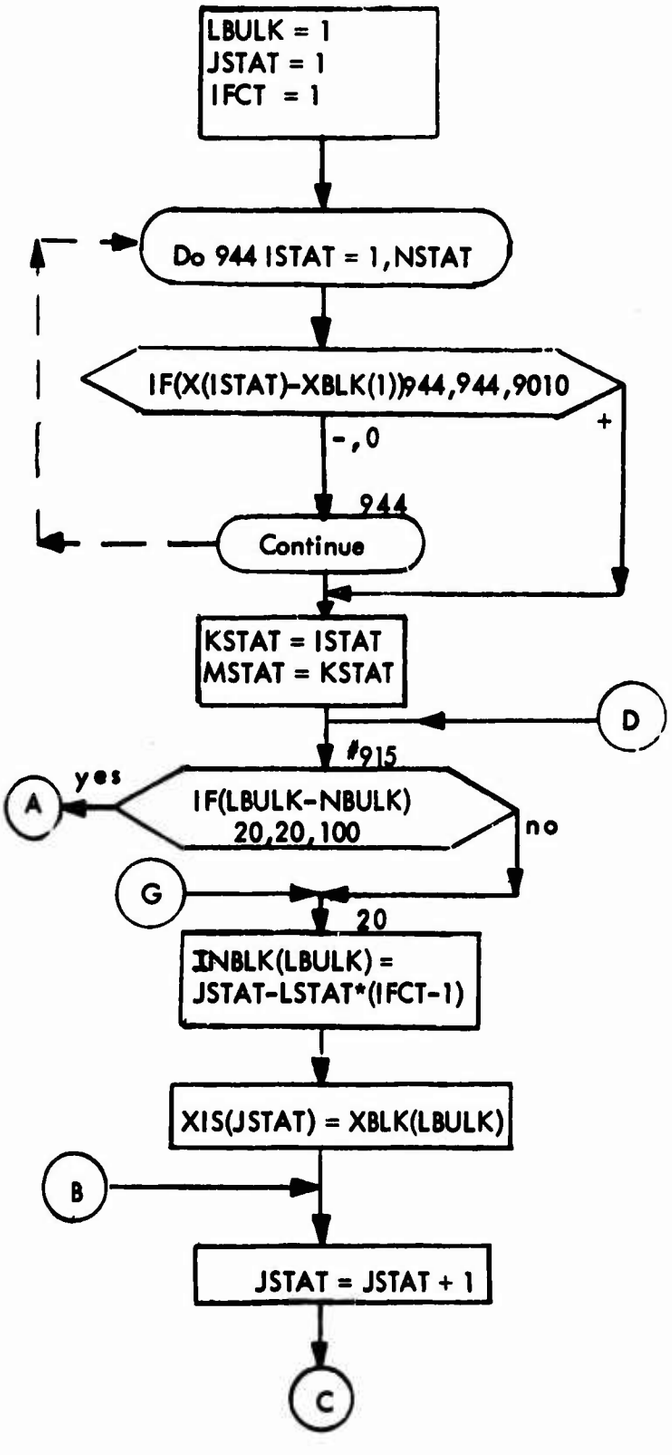
2. Ship Data Table
   X( ) The distance of ship stations from the F.P.
   Z(,) The Z coordinates of the station offsets.
   Y(,) The Y coordinates of the station offsets.

3. Compartment Data Table
   XIS( ) The distance of the compartment station from the F.P.
   ZIS(,) The Z coordinates of the station offsets.
   YIS(,) The Y coordinates of the station offsets.

GENERATE works only with the X ___ arrays, utilizing subroutines SECTN, STORE, and MOD for modifying the Y__ and Z__ arrays. In essence, it determines the station indices in the _IS arrays where the bulkheads and intermediate ship stations will be located. Figure 1 illustrates the transfer of information involved.

SUBROUTINE GENERATE	SYMBOL LIST
KSTAT	Index of ship stations in the Ship Data Table.
JSTAT	Index of compartment stations in the Compartment Data Table.
LBULK	Index of bulkheads in bulkhead arrays.
NSTAT	Number of stations in one ship hull.
LSTAT	Number of stations in one compartment hull.
MSTAT	Index of 1st station aft in X, Y, Z array of foreward most bulkhead.
ICAT	1 - ship single hull; 2 - ship double hull.
JCAT	1 - compartment single hull; 2 - compartment double hull.

SUBROUTINE GENERATE



FLOWCHART

Set bulkhead index LBULK, compartment section index JSTAT, and control character IFCT equal to 1.

Locate first ship station aft of foreward most bulkhead.

Store index of this station in KSTAT and MSTAT.

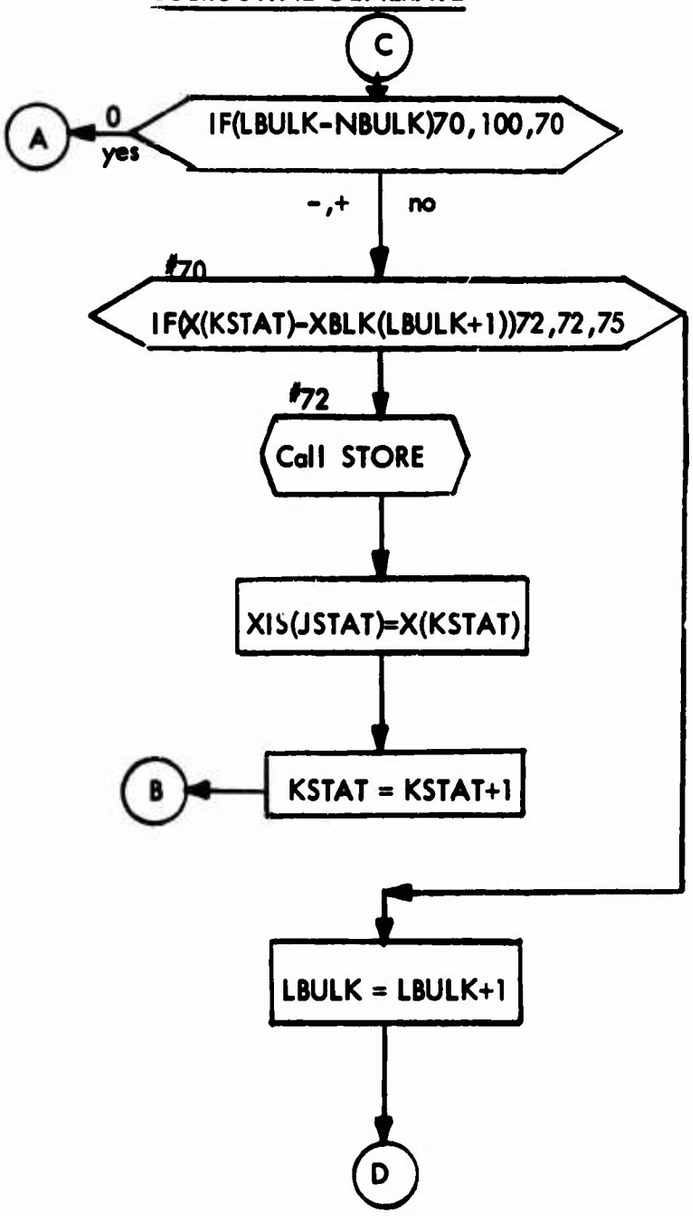
If this is the last bulkhead, go to #100.

Store index of bulkhead in compartment section arrays in INBLK (LBULK).

Store X of bulkhead in XIS array.

Increase index of IS arrays by 1.

SUBROUTINE GENERATE

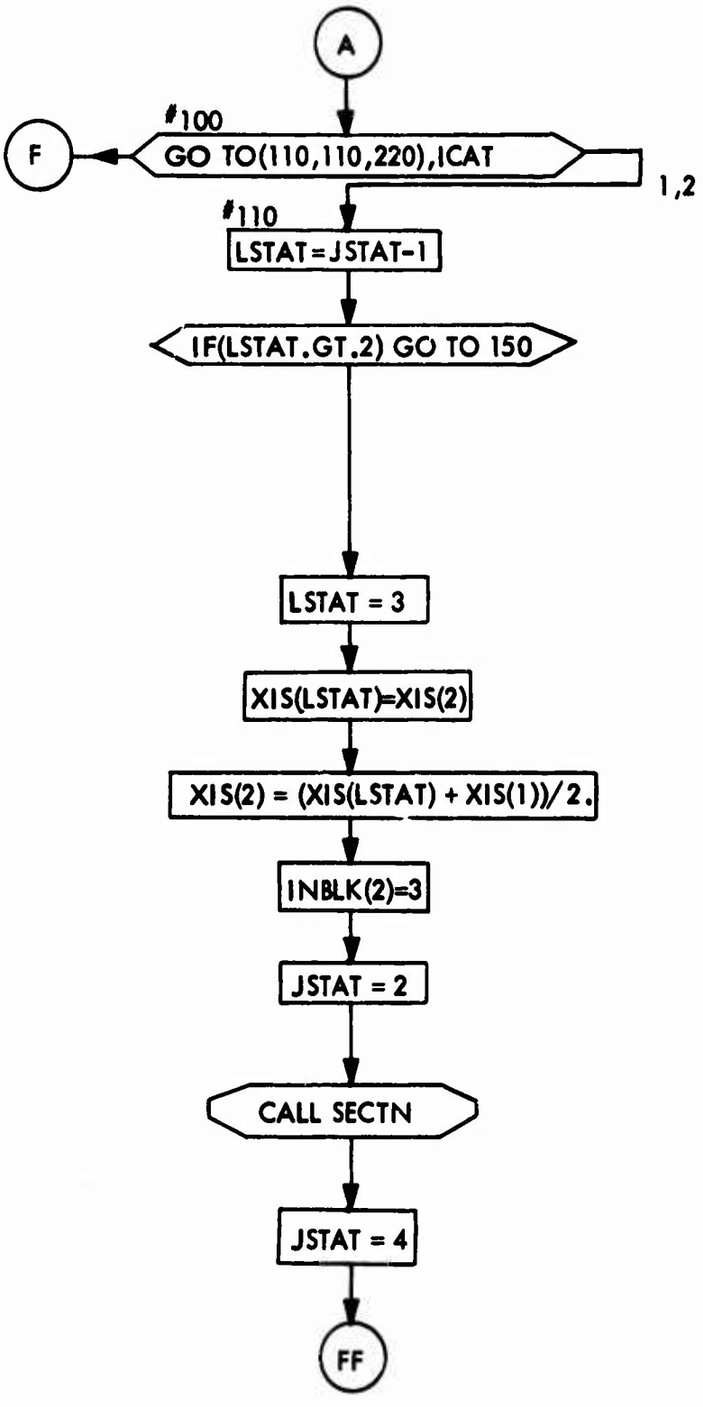


FLOWCHART (continued)

If this is last bulkhead, go to 100

If the ship station at X(KSTAT) is foreward of the next bulkhead XBLK (LBULK+1), this ship station lies within the bounds of the compartment. Transfer the offsets of the ship station to the sections position in the compartment (IS) arrays using Subroutine STORE, store the station location in XIS(JSTAT); and increase the compartment section index, KSTAT.

If X(KSTAT) is aft of the next bulkhead X(LBULK+1), increase the bulkhead index by 1, go to



If this is the 2nd pass through for a double hull ship, GO TO 220.

LSTAT = number of stations, including bulkheads, in the compartment.

If LSTAT is not greater than 2, no station in the Ship Data Table lay between the two bulkheads. An intermediate station must be generated in order to preserve the curvature of the hull.

Number of compartment station = 3.

Move 2nd bulkhead to station 3.

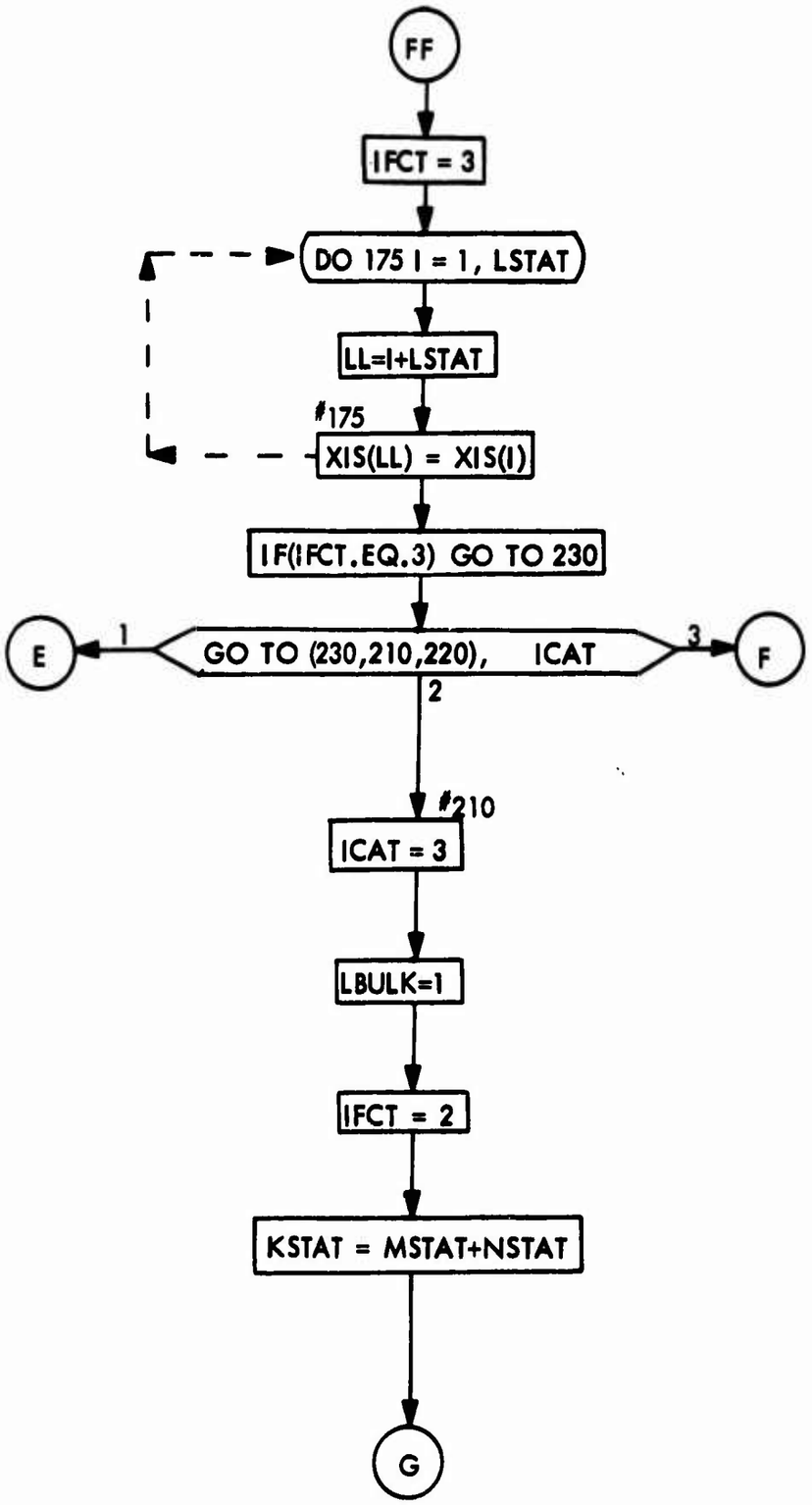
New intermediate station halfway between bulkheads.

2nd bulkhead located at station 3.

Station index = 2.

Compute offsets of intermediate station in Subroutine SECTN.

Station index = 4.



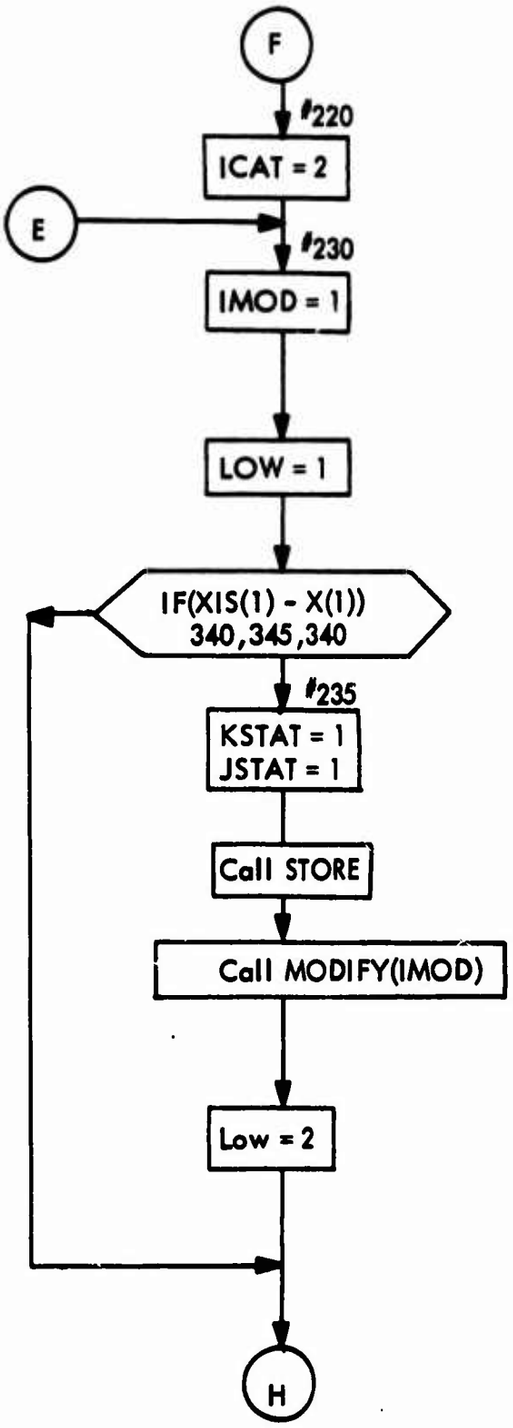
Control character.

Store X of compartment stations in positions where inner compartment hull will be stored. Storage is sequential - outer hull, then inner hull.

If ICAT = 1, the ship has a single hull, GO TO 230.
If ICAT = 3, the ship has a double hull and this is the second pass, GO TO 220.

If ICAT = 2, the ship has a double hull and this is the first pass. The inner hull must now be considered. Set ICAT = 3 and IFCT = 2 for control purposes; reintialize LBULK, the bulkhead index, and set the ship station index KSTAT at the location of the first inner hull station aft of the foreward most bulkhead. Go back to store inner hull ship stations.

SUBROUTINE GENERATE



FLOWCHART (continued)

Reset ICAT

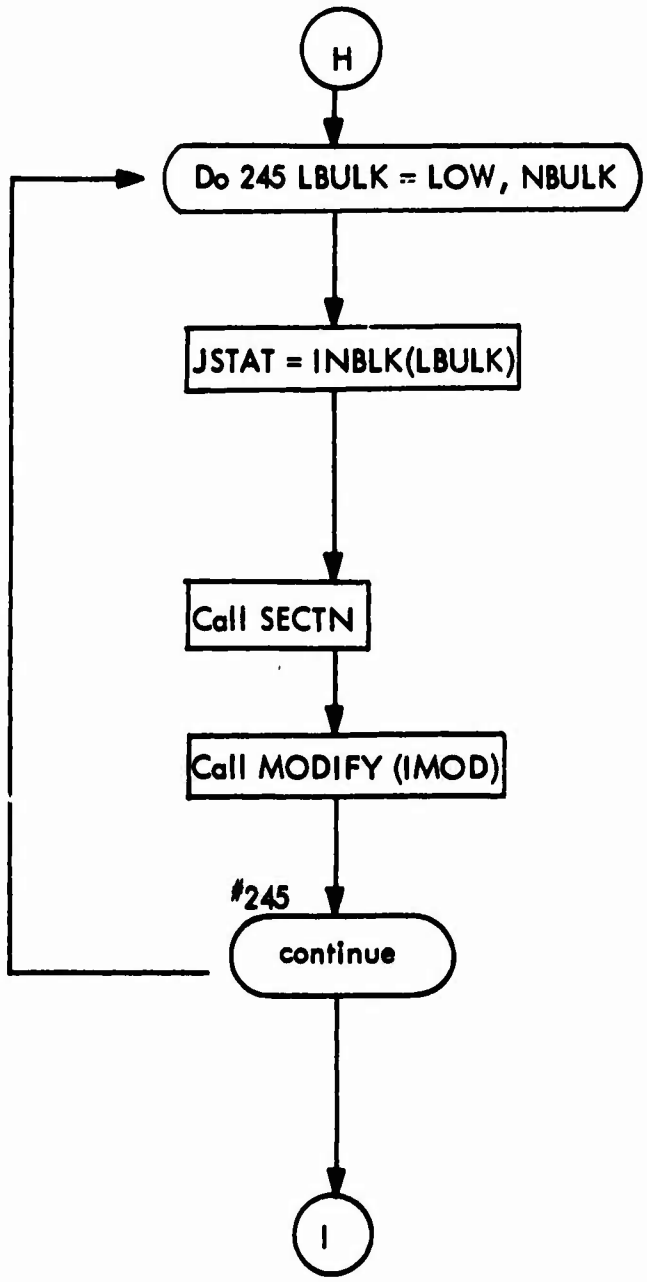
Indicator for Subroutine MODIFY signifying that bulkheads, as distinguished from intermediate stations, are being considered.

Index of 1st bulkhead to be calculated by Subroutine SECTN

If the first bulkhead lies on the first ship station, Subroutine SECTN may not be used. The offsets of the first bulkhead, which is the first station, are transferred to the IS arrays via Subroutine STORE. Subroutine MODIFY is then called to modify these offsets in accordance with the bulkhead outline description contained in the arrays ZINT and YINT.

Low is reset to 2, the second bulkhead.

SUBROUTINE GENERATE



FLOWCHART (continued)

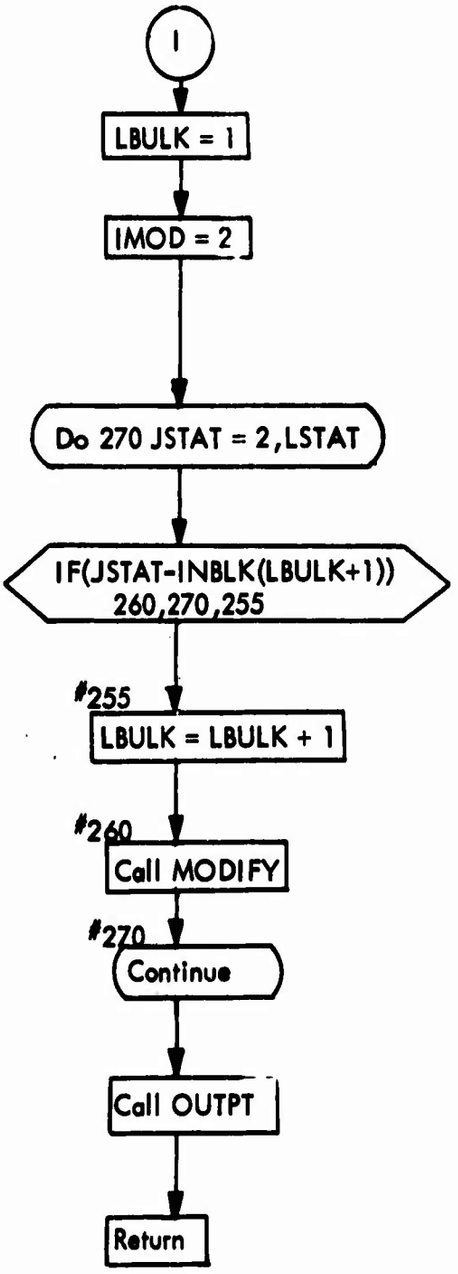
Do for each bulkhead.

INBLK(LBULK) contains the index in the IS arrays where bulkhead LBULK is to be stored.

Subroutine SECTN calculates the offsets at the bulkhead location of the full ship section and stores them in the IS arrays at location JSTAT

Subroutine MODIFY modifies these offsets in accordance with the bulkhead outline description contained in the arrays ZINT and YINT.

SUBROUTINE GENERATE



FLOWCHART (continued)

Bulkhead index is set to 1.

Indicator for Subroutine MODIFY indicating that intermediate stations, as distinguished from bulkheads, are being considered.

Go through all compartment stations.

If JSTAT is less than INBLK(LBULK+1), which is the index of the next bulkhead, then the station JSTAT in the IS array is an intermediate station; Subroutine MODIFY modifies these offsets in accordance with the bulkhead outline description contained in the arrays ZINT and YINT. If JSTAT = INBLK (LBULK+1), the station is a bulkhead and has already been operated on (See previous page). If JSTAT > INBLK (LBULK+1), increase LBULK by 1.

Print offsets of compartment.

Return to Subroutine CMPRTMNT

SUBROUTINE SECTN

Description:

Generally, hull offsets are given only for ordinate stations. Many applications, however require offsets at intermediate locations. SECTN finds the hull offsets for an intermediate section lying between two ordinate stations.

Fig. 1 shows a typical situation with an intermediate section to be defined

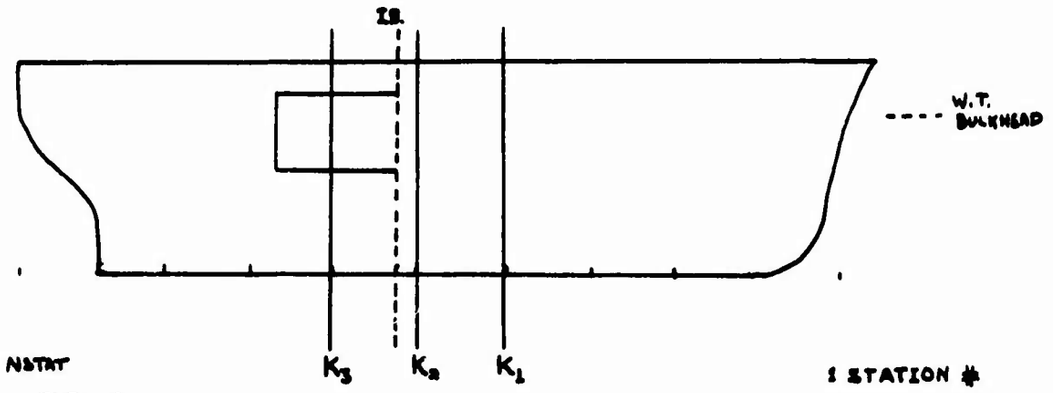


FIG. 1

between ordinate stations K_2 and K_3. Since the intermediate section (abbr. I.S.) is taken closer to ordinate K_2 than K_3, it is reasonable to assume that the hull at I.S. will be shaped more like the section at station K_2 than that at K_3. Therefore if offsets for K_2 are given at certain drafts $Z(K_2,I)$, I=1, NP and we assume this set of offsets properly describes the hull shape, then defining offsets for I.S. at these same drafts should give a reasonably good representation of the hull shape at I.S. This means that any irregularities in K_2 will show up also in I.S. To further emphasize the similarity, if station K_2 has a breakpoint at draft $Z(K_2,IBP)$ we define a breakpoint for I.S. at this draft.

Having chosen a draft, $Z(K_2,I)$, offsets on K_1 and K_3 can be found either because they themselves are given as input or can be interpolated from the offsets which are. When possible, then, a smooth second order curve is passed through the points on K_1, K_2 and K_3 defined by the given draft and the corresponding offsets. The offset on I.S. for a draft of $Z(K_2,I)$ is then assumed to lie on this curve, its exact value being determined from the relative spacing (measured in distance from the F.P.) of K_1, K_2, I.S., K_3.

The meaning of the "when possible" is illustrated in Figs. 2., 3.

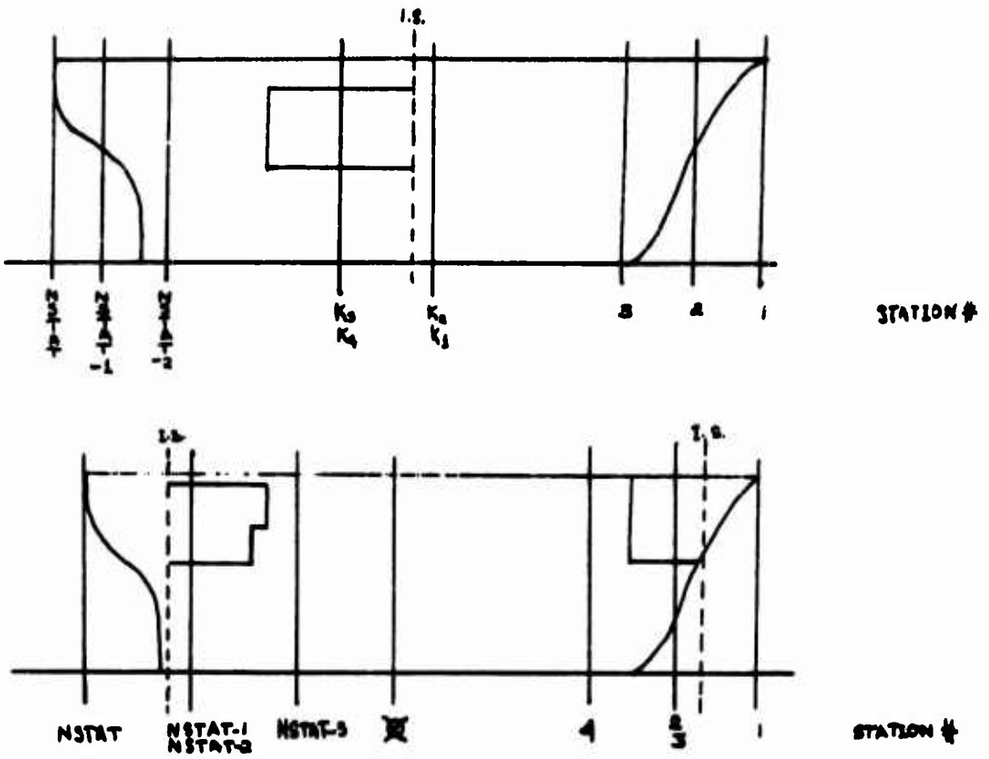
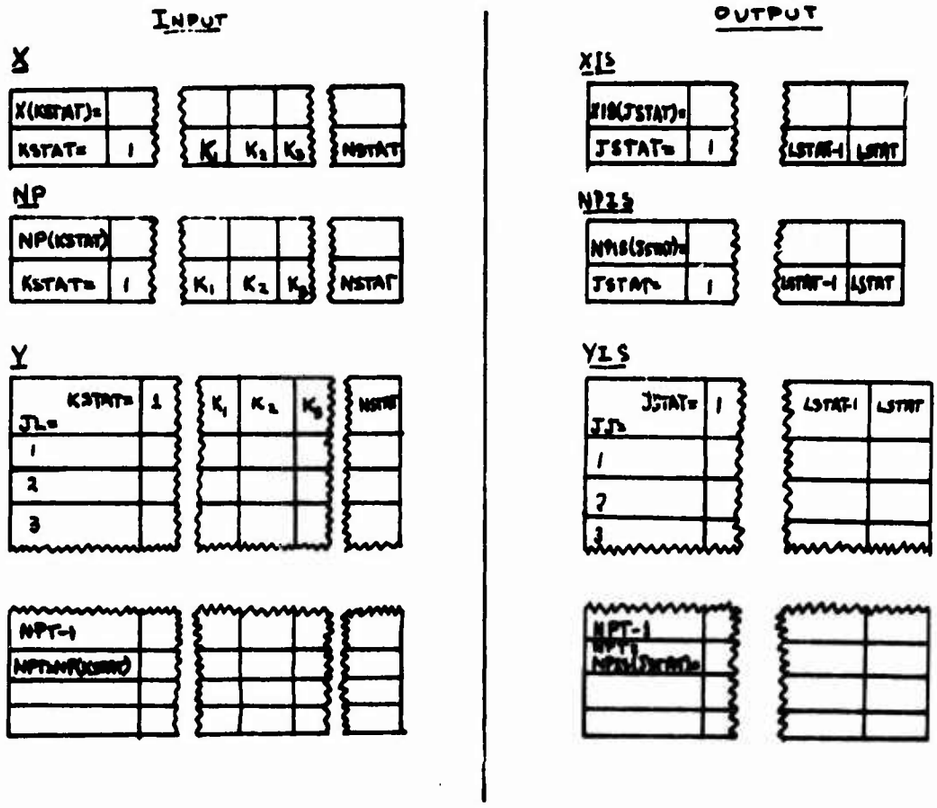


Figure 2 illustrates the situation when K_1 and K_2 both designate the same "double" station which is the usual manner in which abrupt changes in the hull (discontinuities in the waterplane or half-breadth plan) are handled. Figure 3 illustrated an intermediate section located adjacent to the first and last stations. In all three cases and in any of the possible combinations there are not three stations which can give a meaningfully continuous curve with which to interpolate the I.S. offsets. In these cases a simple linear interpolation is used.

When all the required offsets have been stored the intermediate hull section is defined unless the ship has a "double hull". In this case only the outer hull has been defined and a second pass through the routine is necessary to handle the inner hull.

Program Method (Introduction)

Below is a somewhat simplified functional diagram which should help to clarify some of the indexes and operations used in SECTN.



Z constructed like Y table.

JBREAK constructed like Y table except bottom row index = 10, the maximum number of breakpoints, instead of NPT.

ZIS table constructed like YIS table.

JBPIS table constructed like YIS table except only has 10 rows, the maximum number of breakpoints, instead of NPIS rows.

Diagram I

1) Basically, a single pass through SECTN selects 3 indices K_1 K_2 K_3 (the notation is somewhat altered in the program listing) representing consecutive ordinate stations such that I.S. is closest to ordinate station K_2. These three indices specify three numbers in the NP array representing the number of offsets on each station. The indices also specify three columns in each of the Y and Z arrays. SECTN operates on these columns in such a way as to create a new column

$$YIS(JSTAT,JJ)\Big|_{JJ=1}^{NPIS} \text{ and a new column } ZIS(JSTAT,JJ)\Big|_{JJ=1}^{NPIS} \text{ in the YIS and ZIS}$$

arrays respectively. The choosing of which column is to be filled in, i.e. the setting of JSTAT, is external to the routine and need not concern us here. The entries in these columns represent the offset coordinates for I.S. Also, the number of offsets NPIS(JSTAT) is entered from

$$NP(KSTAT)\Big|_{KSTAT=K_2} \text{ and the breakpoint table } JBREAK(KSTAT,JBRK)\Big|_{JBRK=1}^{10}$$

$$\text{is transferred to } JBPIS(JSTAT,JBRK)\Big|_{JBRK=1}^{10} \quad KSTAT=K_2$$

Thus all the data concerning I.S. is entered in the _IS arrays.

2) This describes a basic run through the program. The only time this description is not sufficient is in the case of a double hulled ship. In this case a second pass through SECTN to create the entries for the inner hull is necessary. For a double hulled ship the Y, Z, NP, and JBREAK arrays are each expanded by a factor of 2 to 2*NSTAT in the horizontal dimension. This is because at each station there are now twice as many entries (inner as well as outer hulls). All the entries for the outer hull precede all the entries for the inner hull.

Similarly, in SECTN, all the _IS arrays (except XIS since the locations of the sections remain the same for inner and outer hulls) have their horizontal dimensions doubled to 2*LSTAT.

On this second pass through SECTN, the proper data for station K_2, for example is now found NSTAT columns to the right in column K_2 + NSTAT. Likewise, if the I.S. offsets on the outer hull were stored in columns NSTAT of YIS and ZIS the offsets on the inner hull will be stored at columns JSTAT + LSTAT.

Now follows a detailed description of the actual program. In reading this a listing of SECTN should be referred to,

Detail:

(Variable names are defined in the next section) The upper limit, LIM, of a DO statement is set to the number of ordinate stations less one. The function of the loop is to locate the position of I.S. between two adjacent stations. To do this the following function is calculated:

$$DIS = \frac{(X_{i+1} - XIS)}{XIS - X_i}$$

The properties of DIS are given in the table below for $XIS \neq X(1)$.

TABLE I

DIS- Relation between arguments

a.	<0	$XIS < X_i < X_{i+1}$ or $X_i < X_{i+1} < XIS$
b.	$=0$	$XIS = X_{i+1}$
c.	>0	$X_i < XIS < X_{i+1}$
d.	>1	$(XIS - X_i) < (X_{i+1} - XIS)$ i.e. XIS is closer to X_i
e.	<1	$(X_{i+1} - XIS) < (XIS - X_i)$ i.e. XIS is closer to X_{i+1}

The loop is repeated until either condition b. or c. occur. In the event DIS=0 the I.S. lies on one of the ordinate stations, namely on station JW+1. The program exits from the loop and calls a subroutine. Subroutine STORE, which transfers entries from the NP, Y, Z and JBREAK arrays into the corresponding _IS arrays as described under 1) above. In this connection it may be useful to think of the index JW+1 as corresponding to the index K_2. DIS=0 or condition b.

After returning from STORE the program has finished unless the ship is double hulled. If so ICAT=2* and a computed GO TO sends control to Statement 230. Here ICAT is set to 3 to prevent a third pass through SECTN and JW, which for this case corresponds to K_2-1, and JSTAT is transformed as in 2) above. Control is transfered to Statement 5 which, since DIS=0, again results in a CALL STORE and then a transfer to Statement 240 (because ICAT =3). Statement 240 resets JSTAT and ICAT for use in the calling program and returns control to the calling program.

In the event DIS>0, I.S. lies between ordinate stations JW and JW+1. The program exits from the loop and checks for conditions d. or e. of Table I.

DIS > 0 or condition c.

NOTE: From here on the formula 'A⟷B' means that the symbol, A, occurring in the program listing corresponds to the symbol or phase, B, occurring in the section of this documentation called "Program Description".

The object at this point in the program is to designate a variable NCLOS K_2 , and a variable NFAR K_3 (see Fig. 1) unless I.S. lies to the right of K_2 in which case NFAR K_1. In the first case X(NFAR) X(NCLOS), in the second case the inequality is reversed (Statements 30 to 40+00001). In either case X(NCLOS) is the location of the closest ordinate station to I.S. Statement 50 now interpolates, in a straight line sense, the height of the keel of I.S., using statement function FLINT. i.e. The lowest point of I.S. is considered to lie on the line joining the lowest points of stations NFAR and NCLOS

We know at this point between which two stations the I.S. lies and, through the indices NCLOS and NFAR, which of the two is closer.

A) The ideal situation at this point from the point of view of accuracy is to have the I.S. positioned as shown in Fig. 4 (identical to Fig. 1) or 5.

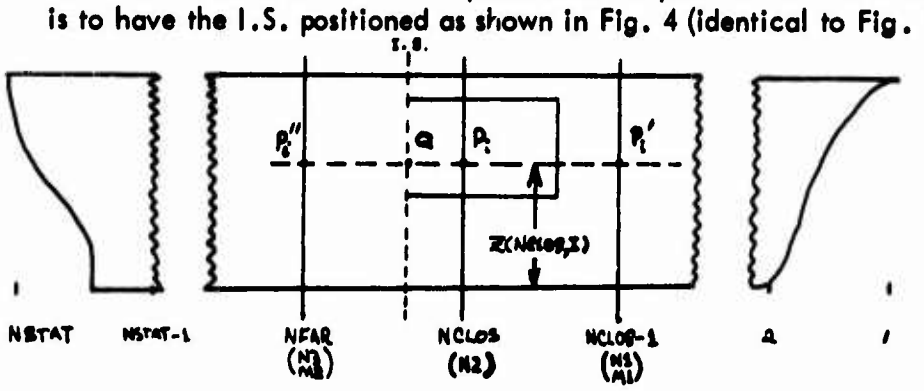


FIG.4

*ICAT is an indicator set by the calling program.

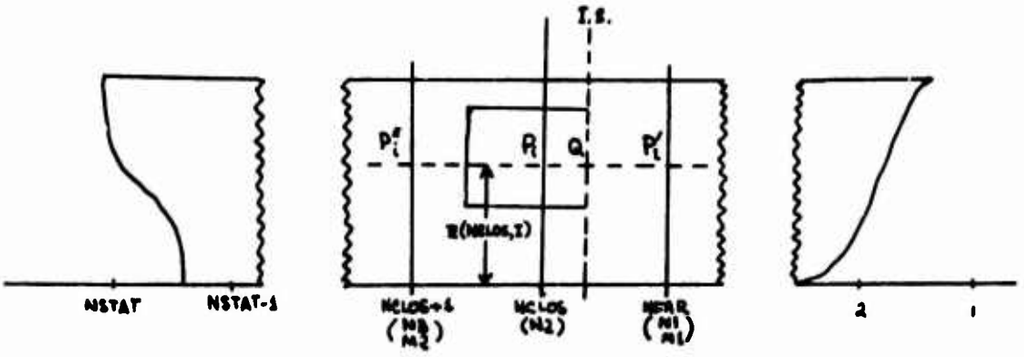


FIG 5

In these cases, to find the coordinates (ZIS(JSTAT,I), YIS(JSTAT,I)) of point Q, which are after all the quantities we are looking for, the procedure is as follows (see loop DO 150, Statement 130+00004):

ZIS(JSTAT,I) is simply the draft, Z(NCLOS,I) of Pi. YIS(JSTAT,I) must be interpolated from the offsets of points Pi', Pi, and Pi". The drafts at these points are all the same. The offsets at each station are found by calling WPLAN1 which returns these offsets in the array Y1. WPLAN1 is thus called 3 times per point Q, once for each station. (DO 140, Statement 130+00006). Then the second order curve, whose coefficients have been found in Statement 130* (CALL COEF11) based on the ordinate values of the sections, is "passed through" Pi', Pi, Pi". (Statement 150). This process is repeated for each point on station number NCLOS (i.e. N2).

This discussion distorts slightly one minor point. It will be noticed from the listing that the offsets and drafts for the ordinate stations have a different index, JL, from the I.S. which uses JJ. This differs from the above usage which seems to imply a one-to-one correspondence between points on station NCLOS and points on I.S. This would indeed be the case except that, whereas points in the output array YIS always start at the beginning with the index JJ=1, it is possible that there may be some unusable points on the ordinate station NCLOS. This will always happen if, for example, station NCLOS has a point whose draft is less than the lowest draft on station NFAR. There would than be no way of interpolating an offset on NFAR as explained in the preceding paragraph. Therefore, the indexing of the ordinate station points begins with the first usable point, J1ST, on station NCLOS (lower index, DO 150, Statement 130+00004). J1ST for the cases pictured in Figs. 4 & 5 is calculated, in Statement 110 through 120, as the first point of closest station with a draft greater than the drafts of the first points of either neighboring station (M1 or M2).

*NOTE: The statements 130+00001, 2, 3 were inserted to prevent the coefficients returned from COEF11 from being written over. The coefficients are used in Statement 150, but COEF11 is again called in Statement 140+00001 by Subroutine WPLAN1.

B) The preceding discussion holds almost unchanged for the cases pictured in Figs. 6 and 7 in which it has not been possible to use a station to the right or left of NCLOS (resp. for Figs. 6 and 7).

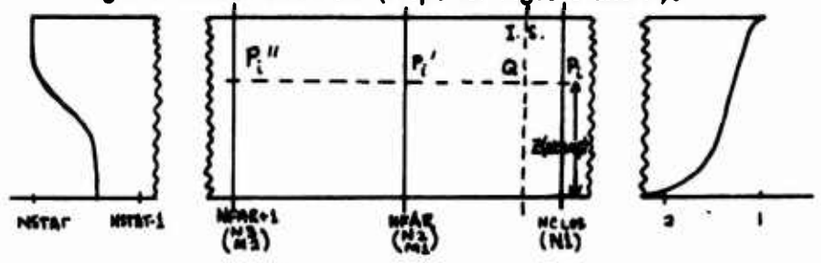


FIG 6

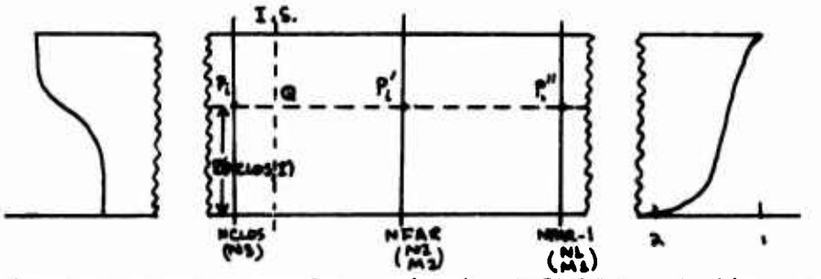


FIG 7

This situation arises most frequently when NCLOS is a double station, but can also occur when NCLOS is either the first or last station on the ship. (It is implicitly assumed here that no great error is introduced in the interpolation for Q due to I.S. being near one end or the other of the fitted curve).

C) The only remaining cases are those pictured in Figs. 2 and 3 where it is not possible to use any ordinate station to the right or left of NCLOS and NFAR and a linear fit is necessary.

For these cases Statements 160 to 170 perform an analogous function to Statements 110-120 discussed under A) above. Similarly, 180 to 200 are completely analogous to Statements 130+00004 through 150. The only difference is in the number of stations and the formula used for the interpolation.

Once the offsets for I.S. have been calculated, control is transferred to Statement 220 which is a DO which transfers the breakpoint table, JBREAK for NCLOS into the JBPIS array. Following this NPIS(JSTAT) = the number of data points on I.S. is set equal to NP(NCLOS), the number of data points on NCLOS.

At this point all the necessary arrays have been filled and the program checks for a double hull (cf. para. 2), P.4).

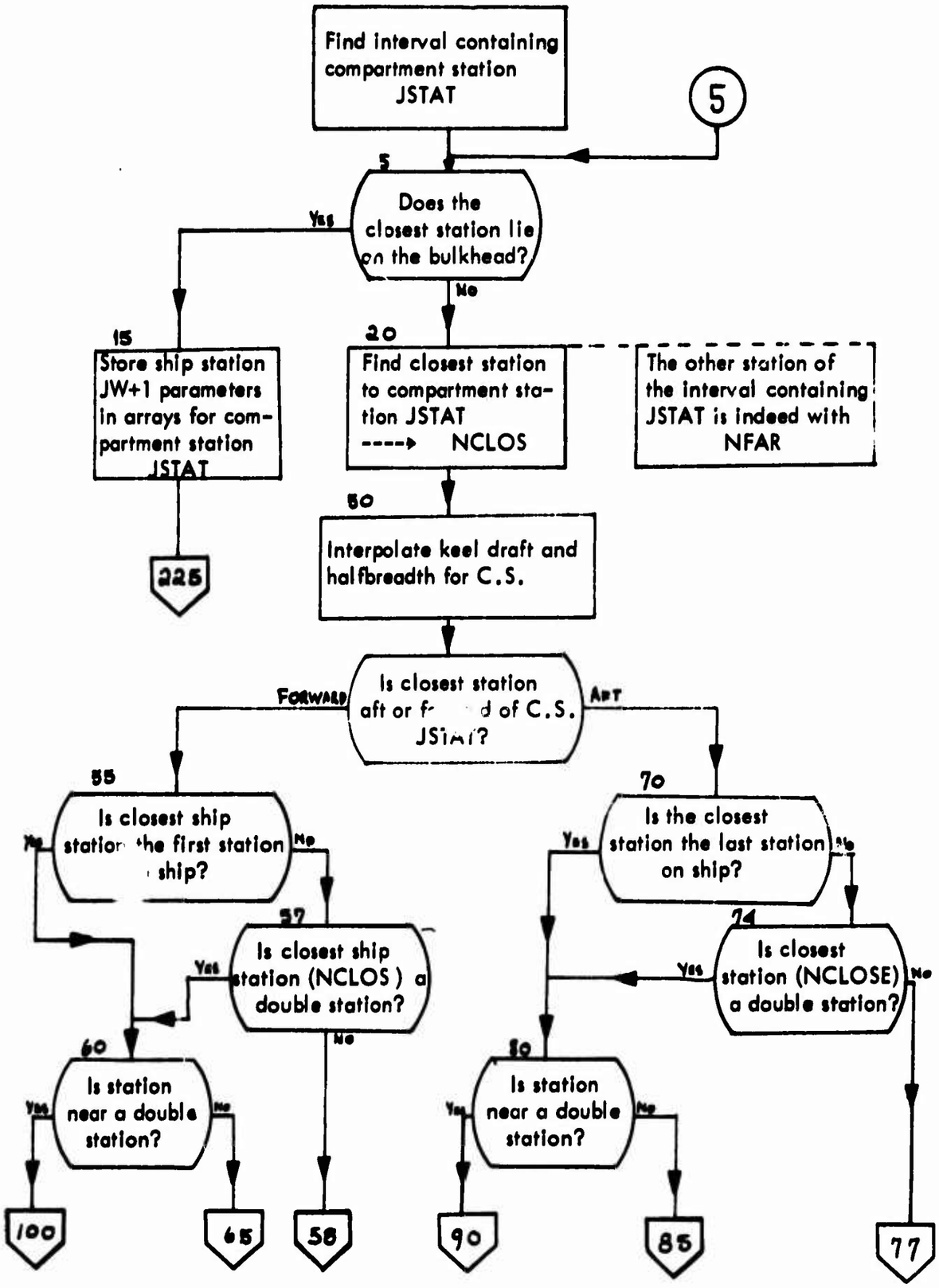
The only statements remaining which have not been covered in detail are 50+00001 through 100 which set the indices N1, N2, N3, M1, M2. But I think that the logic and the output of this section are sufficiently clear from the figures to warrant only this remark: that a statement of the form IF(X(L)-X(L+1))A,B,A where L = NCLOS or NFAR, is a check for a double station as discussed in paragraph B) P. above.

SUBROUTINE SECTN	SYMBOL LIST
DIS	Function used for checking location of I.S.
J1ST	Index of first usable point on NCLOS for interpolation.
JW	Index of lower ordinate station of interval containing I.S.
LIM	Number of ordinate stations less than 1.
N1,N2,N3	Indices for curve fit. N1 corresponds to rightmost station used, N2 the middle station, N3 the leftmost. (F.P. is at right of profile).
NCLOS	Index of ordinate station closest to I.S. which is always one of the stations used in the curve fit.
NFAR	Index of ordinate station next closest to I.S. which is also always used in the curve fit.
M1, M2	Corresponds to two stations used in curve fit other than NCLOS. M1 is always less than M2.

NOTE: Variables, apart from general indices, which appear in the program listing and do not appear above are treated elsewhere in the YGHULL documentation.

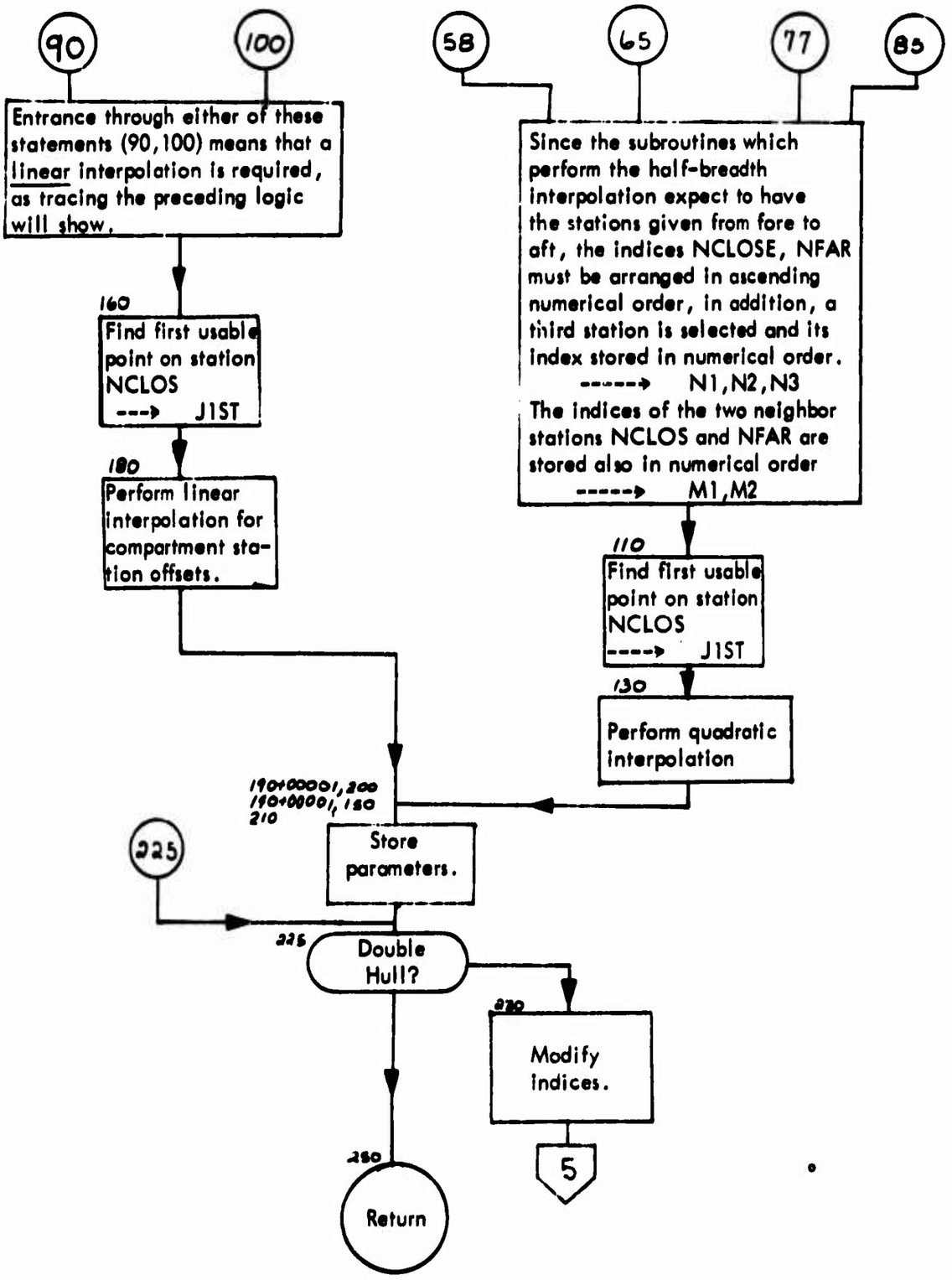
SUBROUTINE SECTN

MACRO FLOWCHART



SUBROUTINE SECTN (continued)

MACRO FLOWCHART



SUBROUTINE STORE

Purpose:

STORE fills the compartment section arrays (__IS arrays) when the section corresponds to a station in the Ship Data Table.

Description: Input consists of:

a. The number of points on the station to be transferred.
b. The offset tables (i.e., Y and Z arrays) from the Ship Data Table.
c. The breakpoint table, JBREAK, also from the SDT.

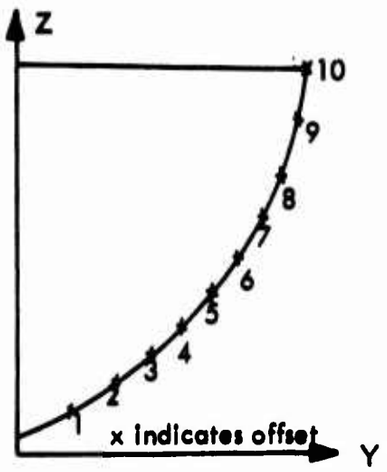
Output consists of the same numbers transferred to the __IS arrays NPIS, YIS, ZIS, JBPIS (see diag. 1 of SECTN documentation).

The transfer is accomplished by two arithmetic statements and two DO LOOPS. Those loops operate on the offset tables and breakpoint table in that order.

SUBROUTINE MODIFY

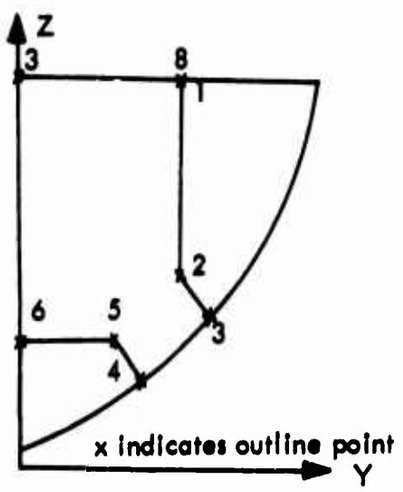
Description:

This program takes the ship section and modifies it in accordance with the description given by the bulkhead outline points. For example, Figure 1 illustrates the ship section and the associated table of offsets; Figure 2 illustrates the bulkhead outline and the associated table of outline points, Figure 3 illustrates the resulting compartment section description and the associated table of offsets.



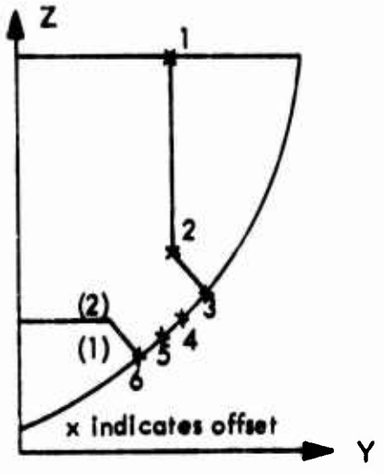
	Y	Z	Breakpoint
1	1.0	.8	*
2	3.0	1.1	
3	4.0	1.5	
4	5.0	2.0	
5	6.0	2.8	
6	6.6	3.2	
7	7.5	4.2	
8	8.0	6.0	
9	8.7	8.0	
10	9.0	10.0	*

FIGURE 1



	YINT	ZINT
1	5.5	9999.0
2	5.5	6.0
3	9999.	5.0
4	9999.	3.0
5	4.0	4.0
6	0.0	4.0
7	0.0	9999.0
8	5.5	9999.0

FIGURE 2



OUTER HULL

	Y	Z	Breakpoint
1	6.4	3.0	*
2	6.6	3.2	*
3	7.5	4.2	*
4	7.6	5.0	
5	5.5	6.0	
6	5.5	10.0	*

INNER HULL

	Y	Z	Breakpoint
(1)	6.4	3.0	*
(2)	4.0	4.0	*

FIGURE 3

SUBROUTINE MODIFY SYMBOL LIST

I Arrays

1. Compartment Data Table arrays

XIS( )	The distance of the compartment station from the FP.
YIS(,)	The Y coordinates of the station offsets.
ZIS(,)	The Z coordinates of the station offsets.
NPIS( )	The number of offsets on each station.
JBPIS(,)	Table of breakpoints for each station.

2. Temporary storage arrays for ship section.

YIST(,)	The Y coordinates of the station offsets.
ZIST(,)	The Z coordinates of the station offsets.
NPIST( )	The number of offsets on the station.
JBPST(,)	Table of breakpoints on each station.

3. Bulkhead Outline Point arrays

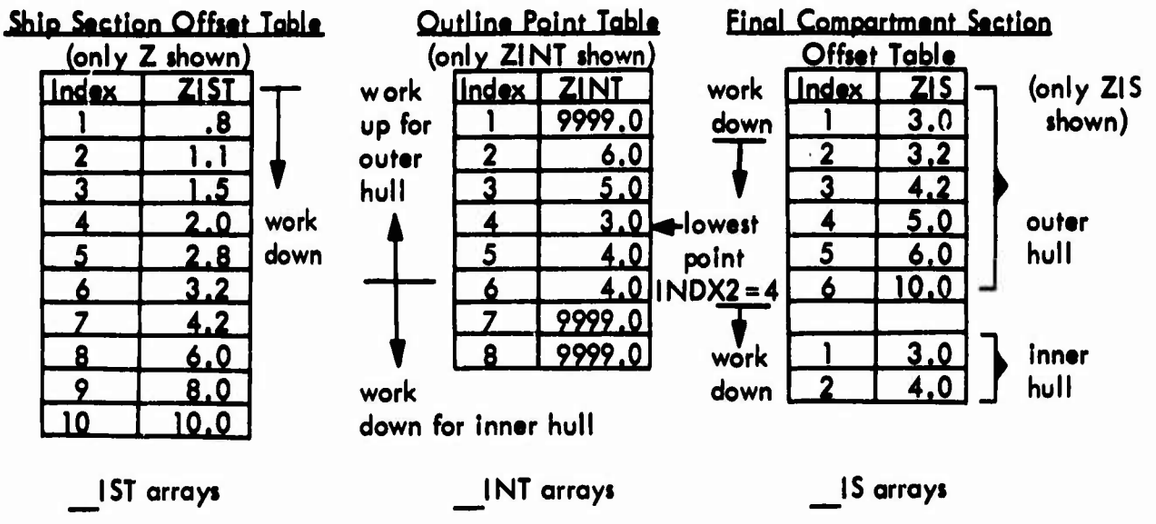
XBLK( )	The distance of each bulkhead from the FP.
ZINT(,)	The Z value of the bulkhead outline points.
YINT(,)	The Y value of the bulkhead outline points.
NINT( )	The number of outline points on each bulkhead.

II Indices and Control Sentinels

INDX1	Outline point index.
INDX2	Index of outline point with lowest Z.
INDX3	Hull index for __IST arrays; 1=outer hull, 2=inner hull.

SUBROUTINE MODIFY	SYMBOL LIST (continued)
INDX4	Index of outline point just below (lower Z) INDX1.
INDX5	Outline point index.
INT	Lower limit of DO LOOP for transferring ship section offsets to Compartment Data Table.
INT1	Lower limit of DO LOOP for outline points.
JSTAT	Station index in Compartment Data Table arrays.
LMT	Upper limit of DO LOOP for outline point.
LMT1	Upper limit of DO LOOP for transferring ship section offsets to Compartment Data Table.
LBULK	Bulkhead index.
L2	Offset index in Compartment Data Table arrays.
L3	Index of intial ship section breakpoint to be tested.
L4	Breakpoint index in Compartment Data Table arrays.
L5	Control sentinel: if outline point being considered is lowest point, 2 if any other outline point.
L6	Control sentinel: 2 if outer hull, 1 if inner hull

NOTES REFERENCED BY FLOWCHART



1. The DO 500 LOOP goes from outline point to outline point (__INT) merging with the ship section offsets (__IST) to form the Compartment Section Offset Table (__IS). This table is created starting at the lowest point, consequently, the Ship Section Offset Table must be looked at from the lowest point and the Outline Point Table must be looked at starting at the lowest point. However, this latter table is in order from the Northeast most point (See Bulkhead Outline Definition Points), clockwise, and consequently the lowest outline point lies somewhere in the middle of the table. Thus the lowest outline point is located and its index stored in INDX2. Since the DO LOOP index must run down the table, the index of the outline point used in expressions must be altered to increase in the order increasing Z's.

When working on the outer hull (using the above illustration) the DO LOOP index runs from 1 to 4 while the actual index should run from 4 to 1. The index expression becomes

INDX1 = LMT - I + 1

where LMT is the number of points in the table (4) and I is the DO LOOP index.

While working on the inner hull the actual index corresponds to the DO LOOP index

INDX1 = I.

Rather than use a COMPUTED GO TO to determine which index is valid, a single expression is used.

INDX1 = (LMT-I+1) * (L6-1) + I * (2-L6)

where L6 is 2 when working on the outer hull, and L6 is 1 when working on the inner hull.

2. INDX4 is the index of the point below INDX1 (lower). For the same reason as in #1. above, this point is located either 1 index higher or lower than INDX1 depending on whether the outer or inner hull is being considered. The resulting expression for the index becomes

INDX4 = INDX1 + I * (L6-1) - I * (L6-2).

3.

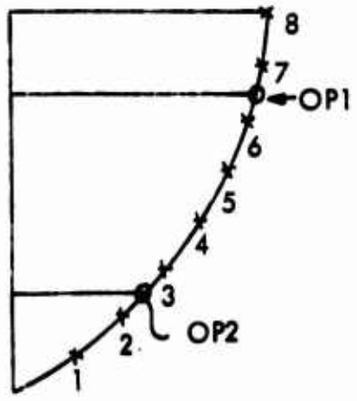


FIGURE 3a.

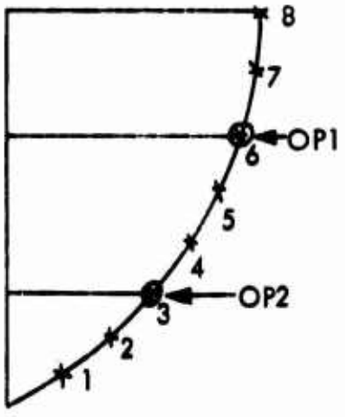


FIGURE 3b.

All ship section points lying between OP1 and OP2 are transferred to the Compartment Section Offset Table.

K = sentinel indicating whether OP1 lies on a ship section offset (whose index is NWP) or between two ship section offsets (whose indices are NWP and NWP+1). The values of K for these two conditions are 2 and 3 respectively.

NWP = index of ship section offset on which lies OP1, or just below OP1 if OP1 is between 2 offsets.

Since only offsets lying between OP1 and OP2 are to be transferred, the index of the upper offset to be transferred is

LMT = NWP - 3 + K.

For example, in Figure 3a., NWP = 6 and K = 3; thus
LMT = 6 - 3 + 3 = 6.

In Figure 3b., NWP = 6 and K = 2; thus
LMT = 6 - 3 + 2 = 5.

INT = index of lowest offset to be transferred. LWP is NWP for the lower outline point, OP2. Thus
INT = LWP + 1.

In Figure 3a., LWP = 2; thus
INT = 2 + 1 = 3.

In Figure 3b., LWP = 3; thus
INT = 3 + 1 = 4.

In summary, offsets 3 to 6 are transferred in Figure 3a., and offsets 4 to 5 are transferred in Figure 3b.

4. INDX5 is the index of the outline point under consideration. The program encounters this statement when considering either the lowest outline point, INDX2, or any other outline point, INDX1. Thus, INDX5 equals either INDX2 or INDX1 depending on the situation. Since L5 = 1 when the lowest outline point is under consideration, and L5 = 2, when any other outline point is under consideration, the resulting expression for INDX5 is

INDX5 = INDX2 * (2-L5) + INDX1 * (L5-1)

5.

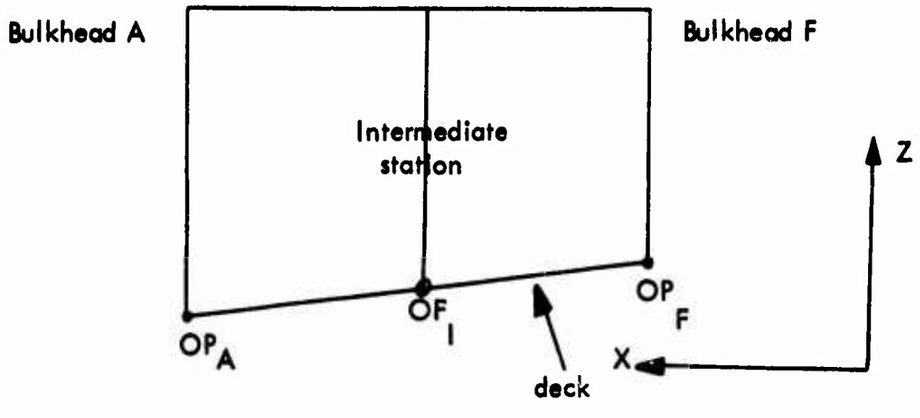


FIGURE 5a.

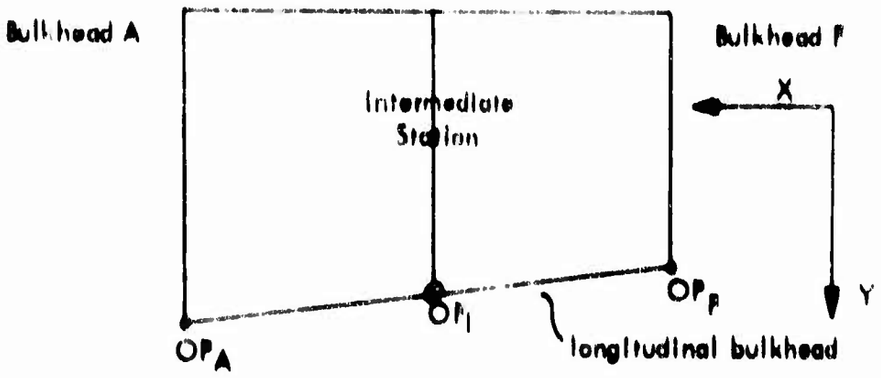


FIGURE 5b.

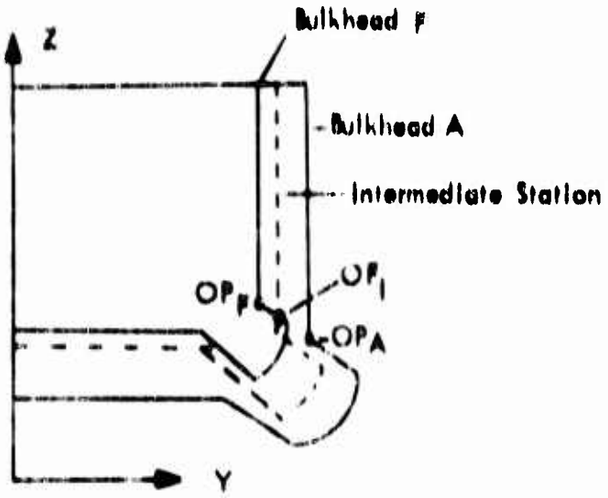


FIGURE 5c.

In the case where a compartment has a boundary of a sloping longitudinal bulkhead a sloping deck, the intermediate station must be modified so that a linear relationship exists between it and the bounding compartment bulkheads.

Thus if $(Z_{OP_A} - Z_{OP_F}) \neq 0$, the corresponding Z at the intermediate station is

$$(Z_{OP_A} - Z_{OP_F}) / (X_A - X_F) * X_I + Z_{OP_F}.$$

If $(Y_{OP_A} - Y_{OP_F}) \neq 0$, the corresponding Y at the intermediate station is

$$(Y_{OP_A} - Y_{OP_F}) / (X_A - X_F) * X_I + Y_{OP_F}$$

6.

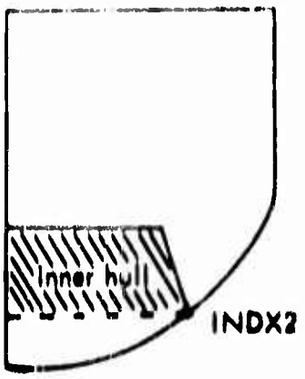


FIGURE 6a.

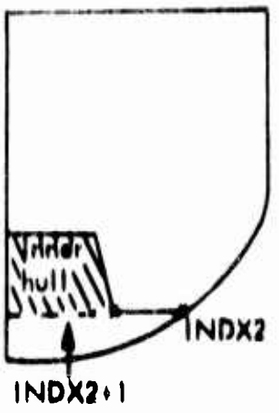
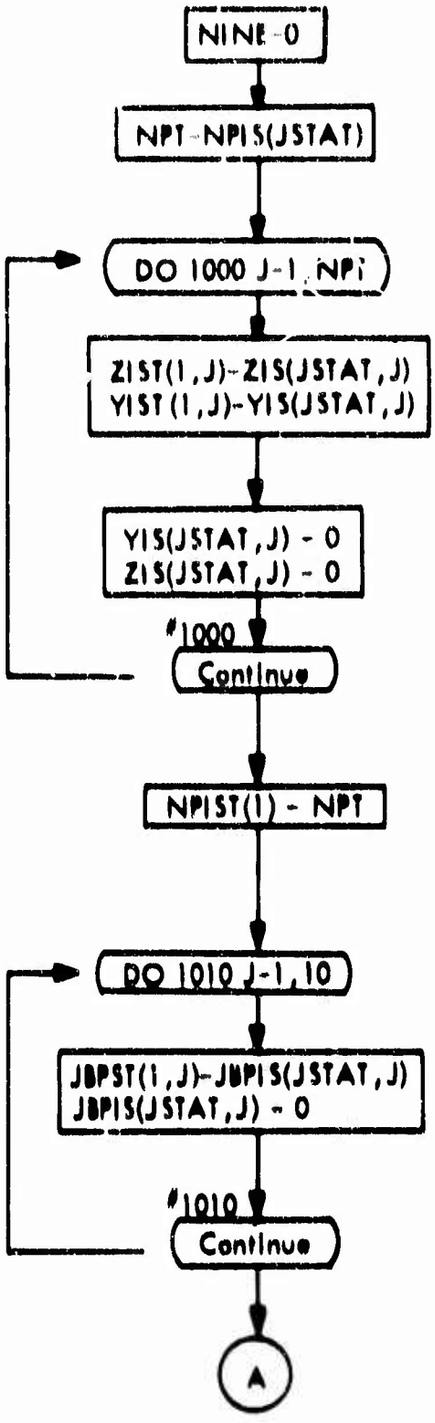


FIGURE 6b.

INDX2 is the index of the first lowest outline point encountered. The inner hull normally starts at INDX2, as in Figure 6a. However if ΔY between INDX2 and INDX2+1 equals zero, as in figure 6b, the inner hull starts at INDX2+1.

SUBROUTINE MODIFY

FLOWCHART



Control character = 0

NPT = number of points on the ship section, outer hull.

Transfer Z and Y points of ship section outer hull to temporary storage arrays ZIST and YIST, outer hull, and clear ZIS and YIS arrays, outer hull, to zero.

Store "number of points" on outer ship hull in NPIST(1).

Transfer breakpoint locations on ship section outer hull to temporary storage array JBPST, outer hull, and clear array JBPIS, outer hull, to zero.

6.

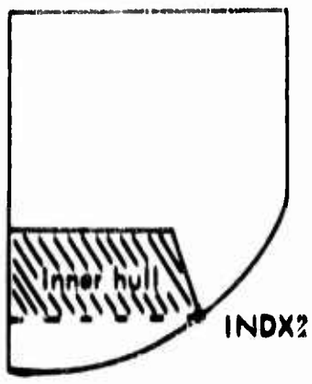


FIGURE 6a.

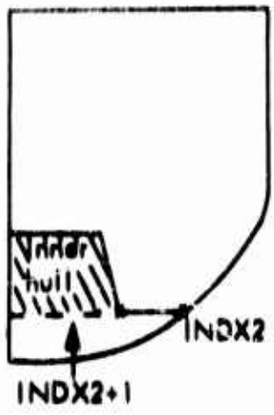
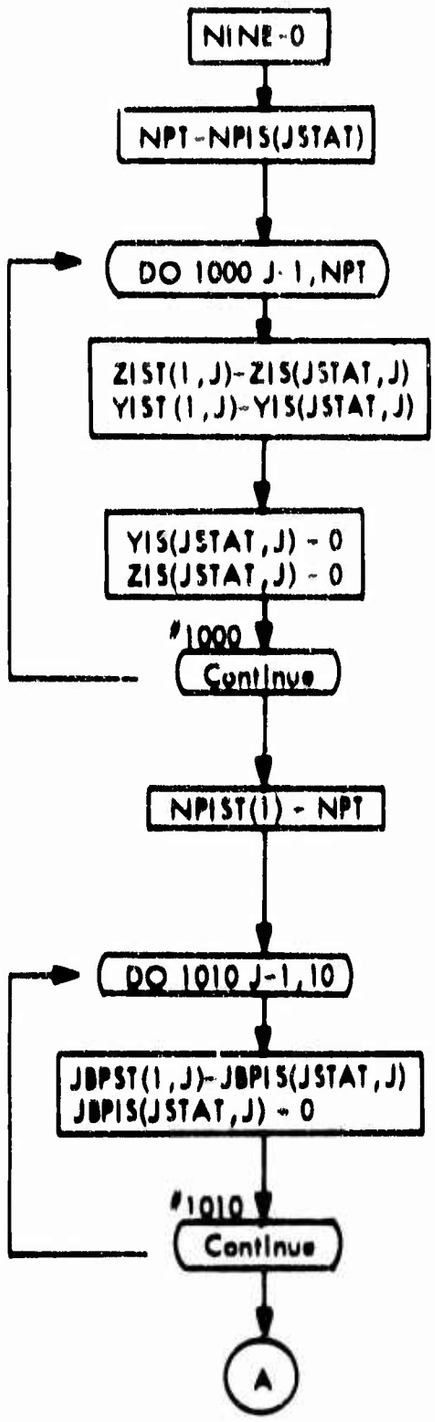


FIGURE 6b.

INDX2 is the index of the first lowest outline point encountered. The inner hull normally starts at INDX2, as in Figure 6a. However if ΔZ between INDX2 and INDX2+1 equals zero, as in figure 6b, the inner hull starts at INDX2+1.

SUBROUTINE MODIFY

FLOWCHART



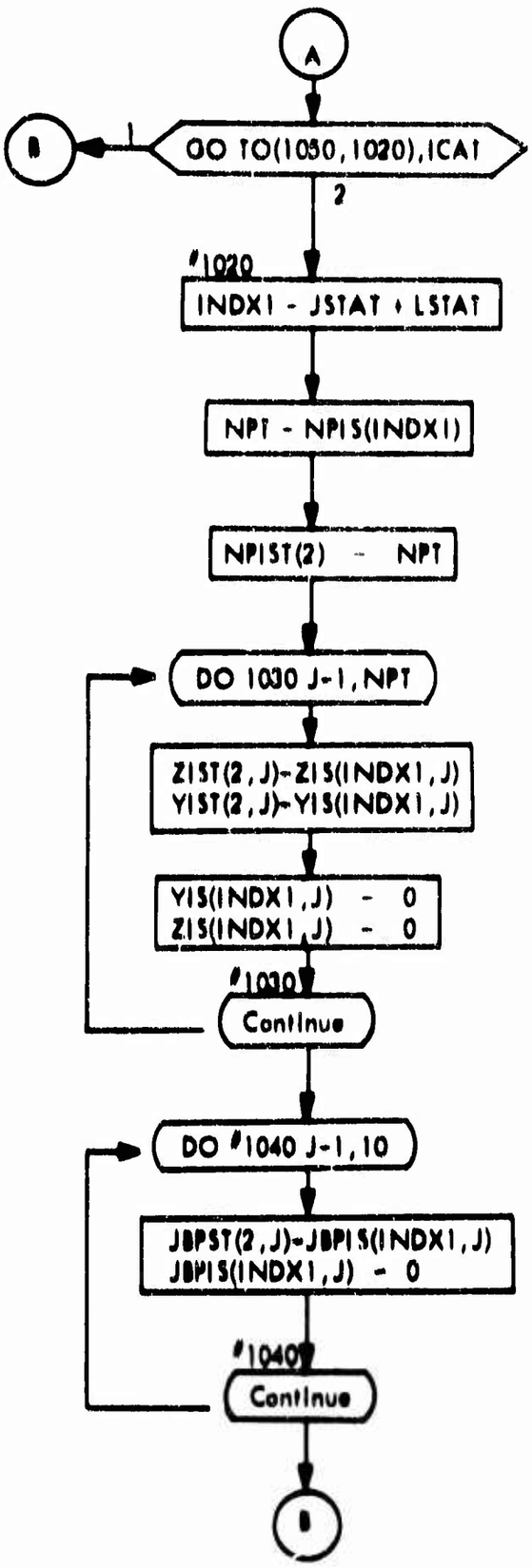
Control character - 0

NPT - number of points on the ship section, outer hull.

Transfer Z and Y points of ship section outer hull to temporary storage arrays ZIST and YIST, outer hull, and clear ZIS and YIS arrays, outer hull, to zero.

Store "number of points" on outer ship hull in NPIST(1).

Transfer breakpoint locations on ship section outer hull to temporary storage array JBPST, outer hull, and clear array JBPIS, outer hull, to zero.



ICAT - 2, ship has 2 hulls GO TO #1020 to transfer inner hull to temporary storage.

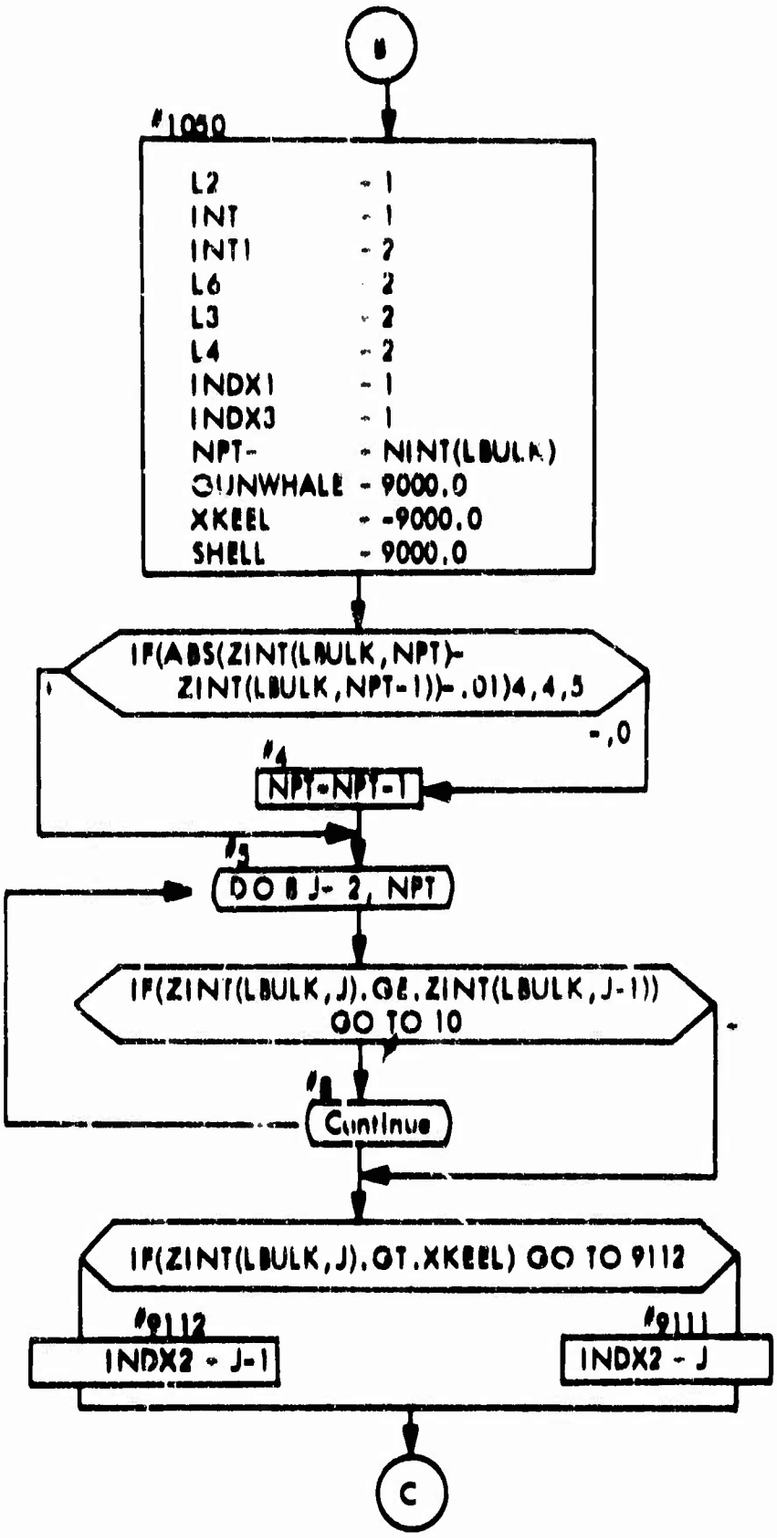
Index of inner hull - index of outer hull + number of stations in compartment hull.

Number of points in inner hull.

Store number of points on inner hull in NPTST(2).

Transfer Z and Y points of station, inner hull to temporary storage arrays ZTST and YTST, inner hull, and clear ZTS and YTS, arrays, inner hull to zero

Transfer breakpoint locations on inner hull to temporary storage array JBPST, inner hull, and clear array JBPTS, inner hull, to zero.

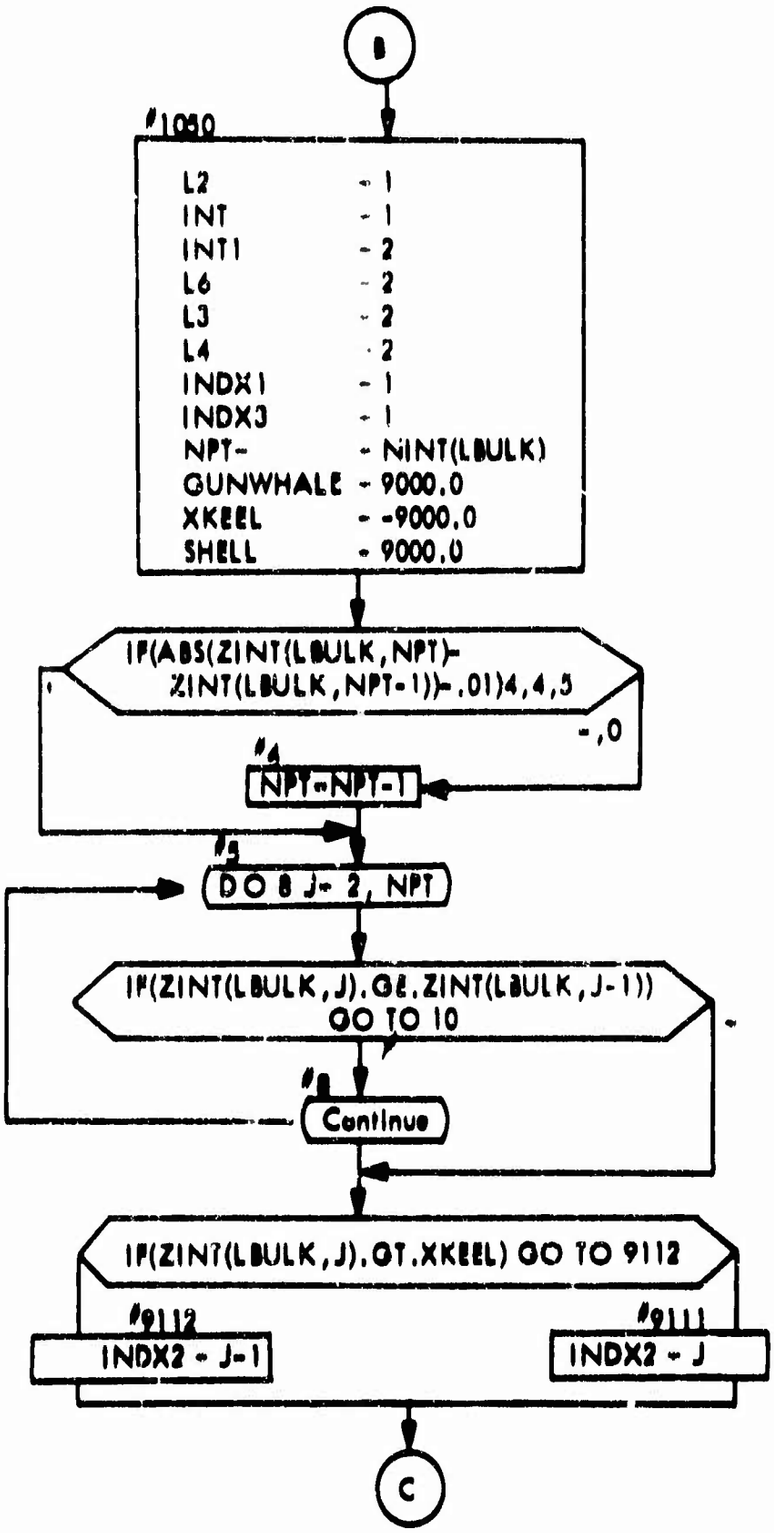


Initialization
(See Symbol List)

Drop consideration of last outline point if Z of that point is same as Z of second to last outline point.

Locate lowest outline point.

If lowest point is at keel, lowest point is at index J; if above keel, it is at J-1. Store index of lowest point in INDX2.



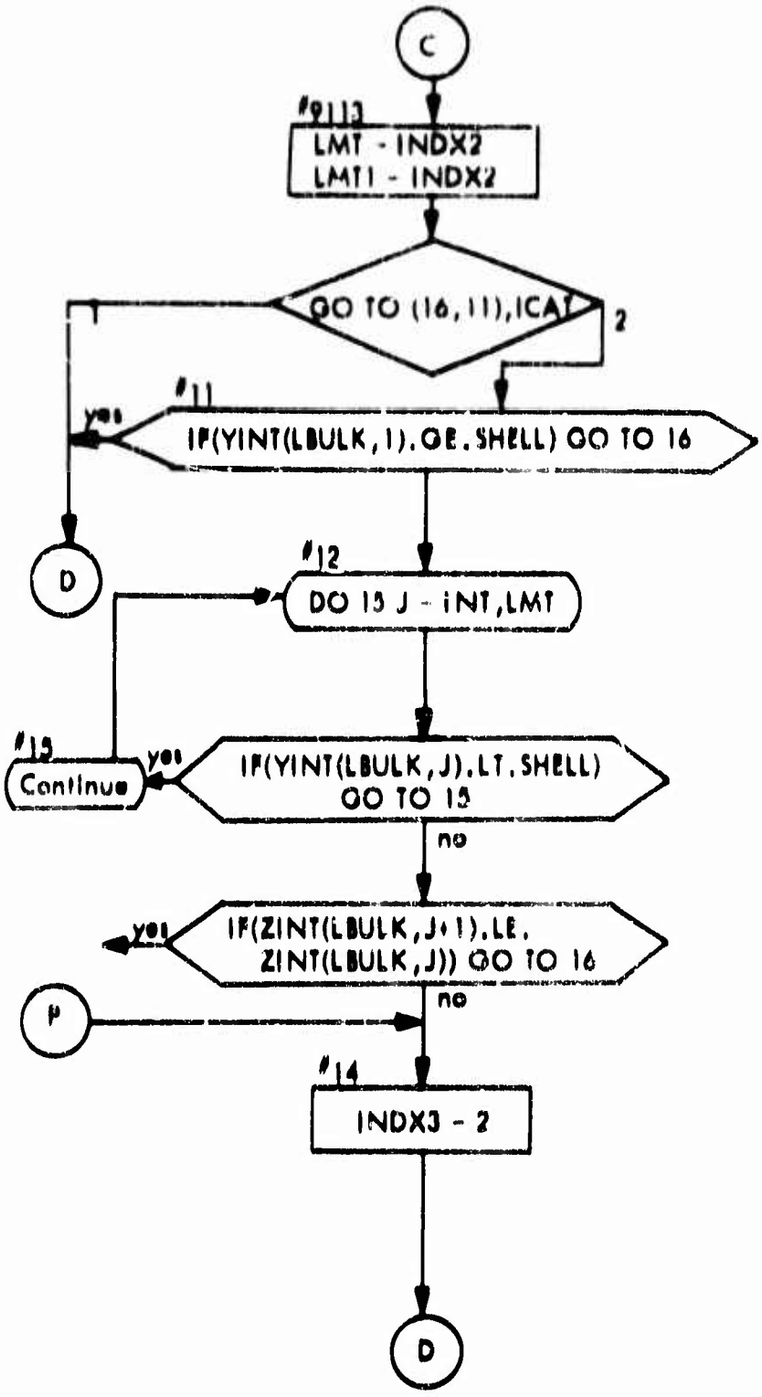
Initialization
(See Symbol List)

Drop consideration of last outline point if Z of that point is same as Z of second to last outline point.

Locate lowest outline point.

If lowest point is at keel, lowest point is at index J; if above keel, it is at J-1. Store index of lowest point in INDX2.

SUBROUTINE MODIFY



FLOWCHART (continued)

LMT - number of outline points for this hull (inner or outer) of compartment.
LMT1 - Do loop limit.

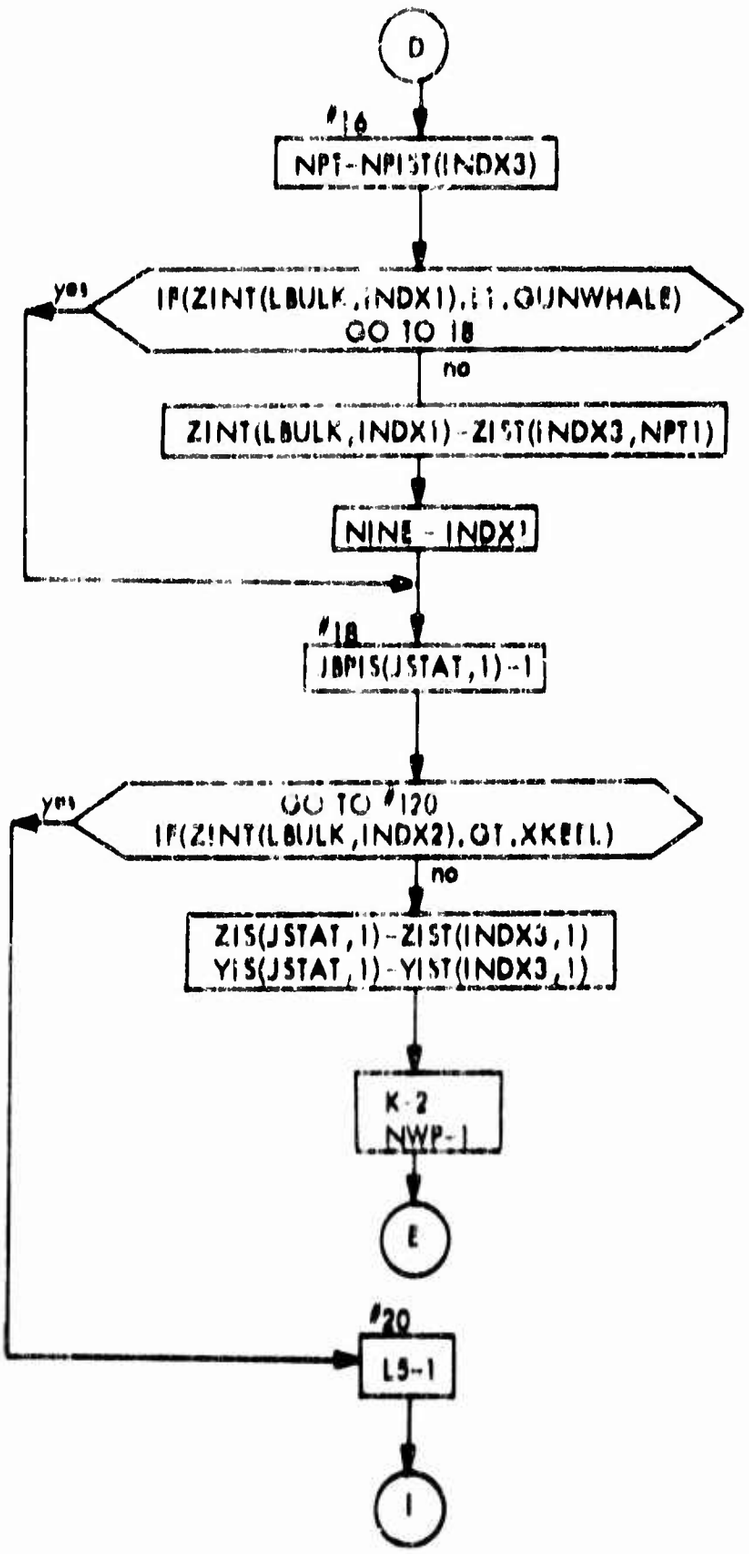
If ICAT - 2, ship has double hull.
If ICAT - 1, ship has single hull.

If first outline point is on shell, it must be on outer hull since points are taken clockwise, GO TO 16; if not, test further.

Test all outline points on this compartment hull.

If point does not lie on shell, go to test next point.

Goin clockwise, and assuming that once the bulkhead intersects the shell it must follow the shell for some distance, then the next outline point must also be a shell intersection. Then if Z of the 2nd point is less than Z of the 1st the intersection must lie on the outer ship hull. If Z of the 2nd point is greater than Z of the 1st, it must lie on the inner ship hull and the ship hull index, INDX3 must be reset to 2.



FLOWCHART (continued)

Number of points on ship hull.

If bulkhead goes to top of ship section, Z value of upper outline point is set equal to Z of upper point on ship section.

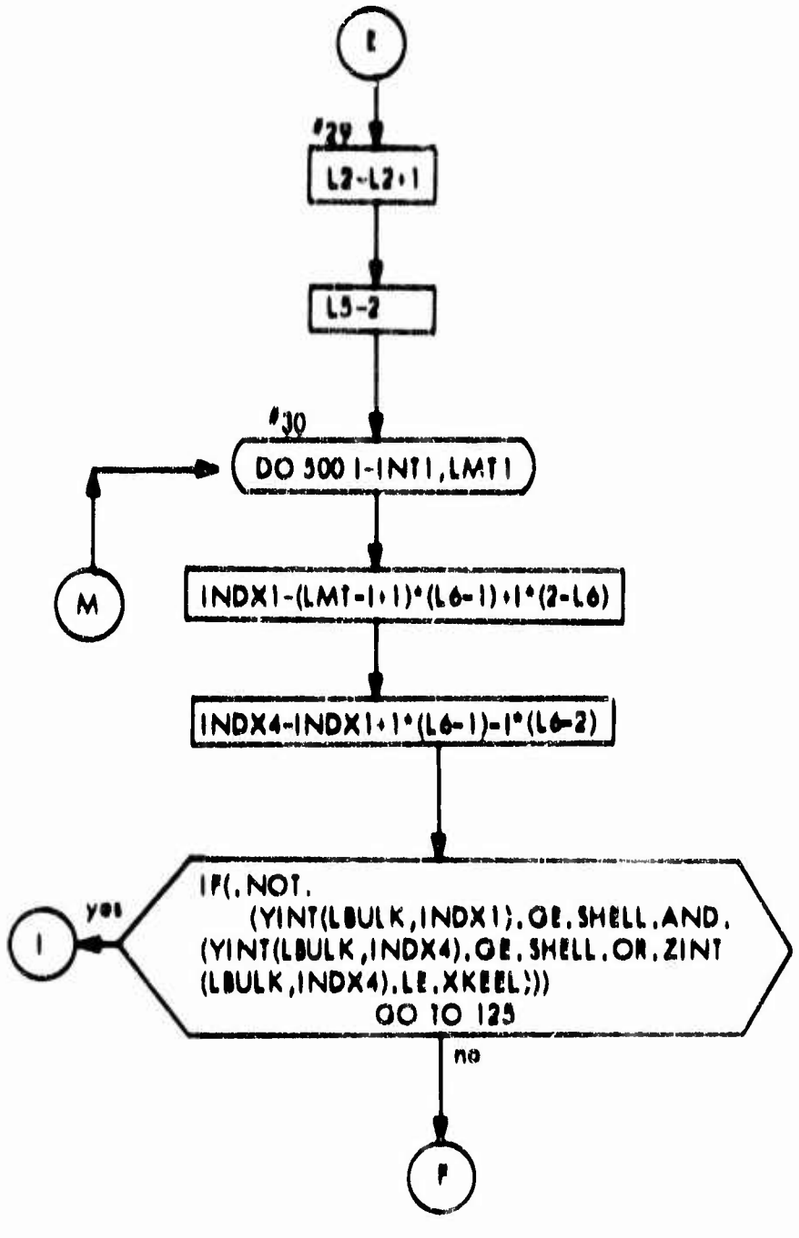
Index of outline point where substitution was made.

First point on compartment station is always a breakpoint.

If bulkhead goes to bottom of ship section, Z and Y of first point on compartment section are set equal to lowest point on ship section.

Sentinel indicating first compartment point lies on a ship point (K-2) and index of that point (NWP-1).

Sentinel indicating use of lowest compartment outline point. (See Statement #125)



Increase index of compartment section points by 1 as storage of point was just completed.

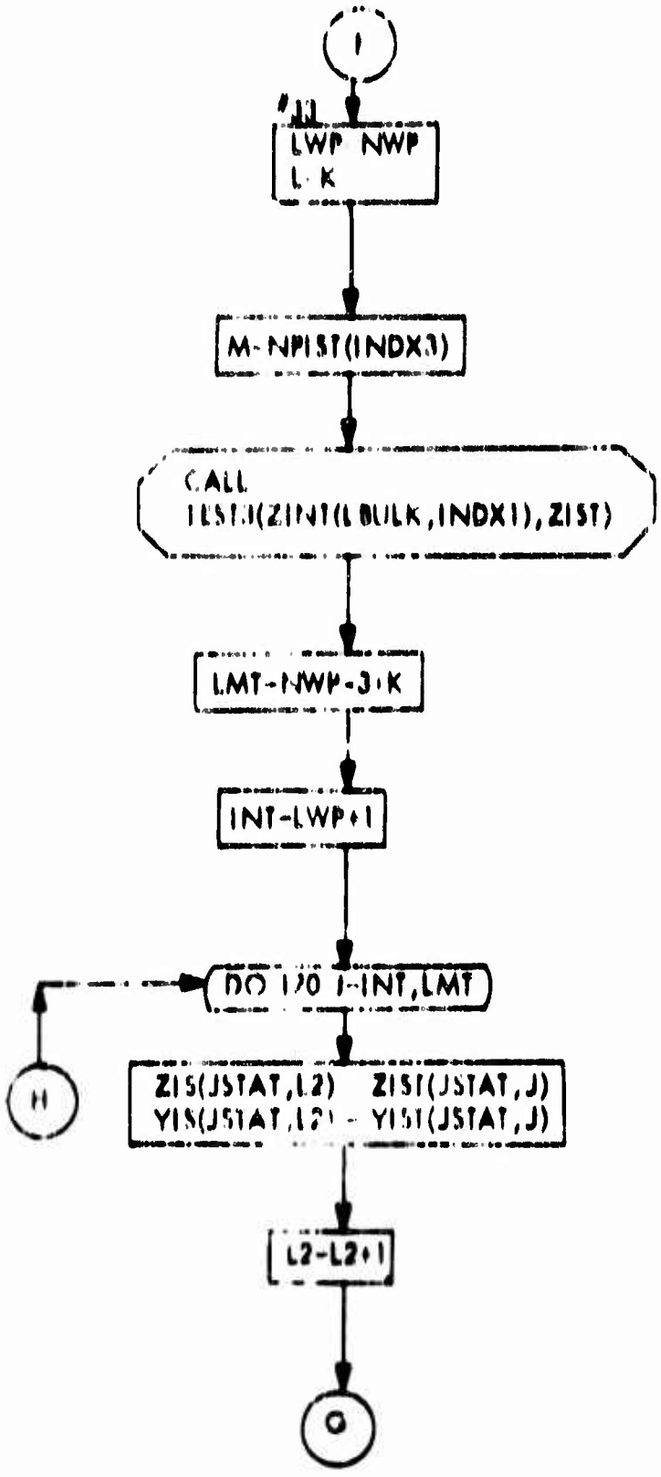
Sentinel indicating use of compartment outline point under consideration (INDEX=INDX1, see area around Statement #125)

Do for each outline point on this compartment hull.

Index of outline point. (See notes, #1)

Index of next highest outline point. (See notes, #2)

If the current outline point is on the shell, and either the previous (lower Z) outline point is on the shell or is the keel, those points on the ship section lying between the two outline points must be transferred to the compartment section; go on. If this statement is not true, the bulkhead does not intersect the shell between these two points, GO TO Statement #125.



Store index, NWP, and location sentinel (indicating point is on NWP or between NWP and NWP+1, (See Subroutine TEST3), K, of last outline point that lies on shell.

Number of points on ship hull section- for Subroutine TEST3.

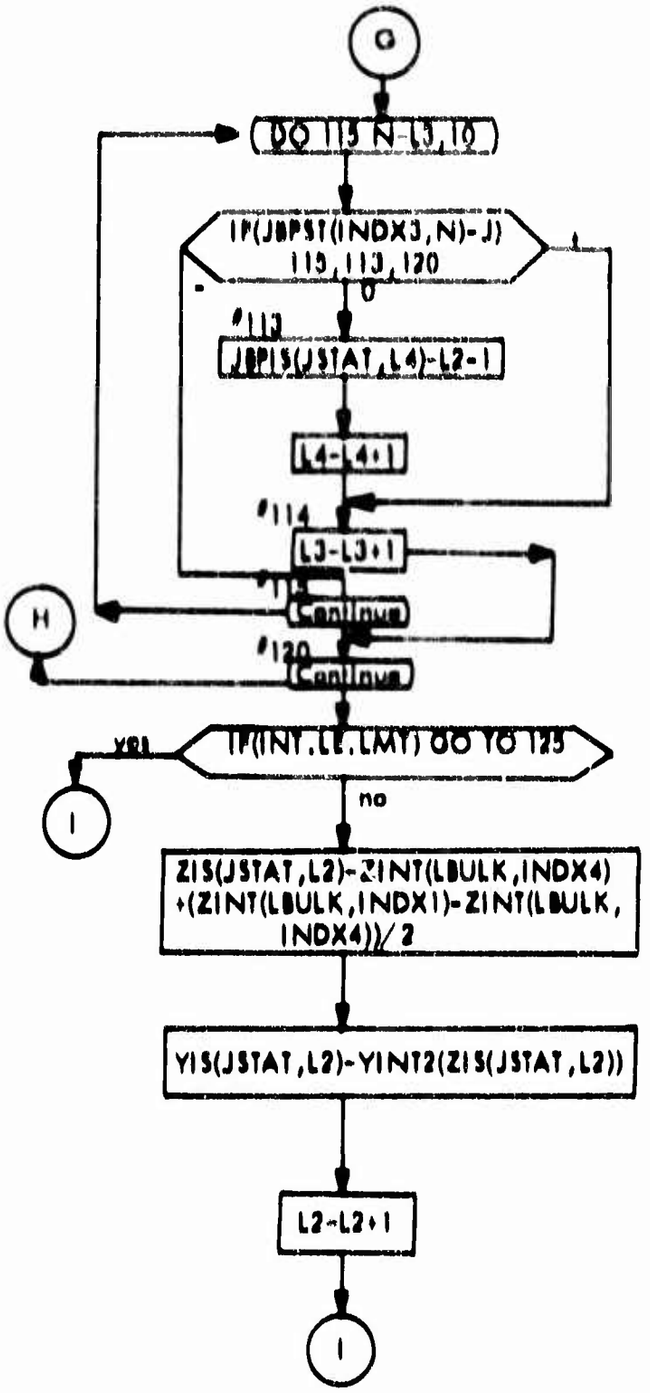
Find relative location of outline point in ship section table of offsets.

Index of highest point on ship section to be transferred to compartment section (See notes, #3)

Index of lowest point on ship section to be transferred to compartment section.

Transfer ship section offsets, index J, to compartment section offset table, index L2.

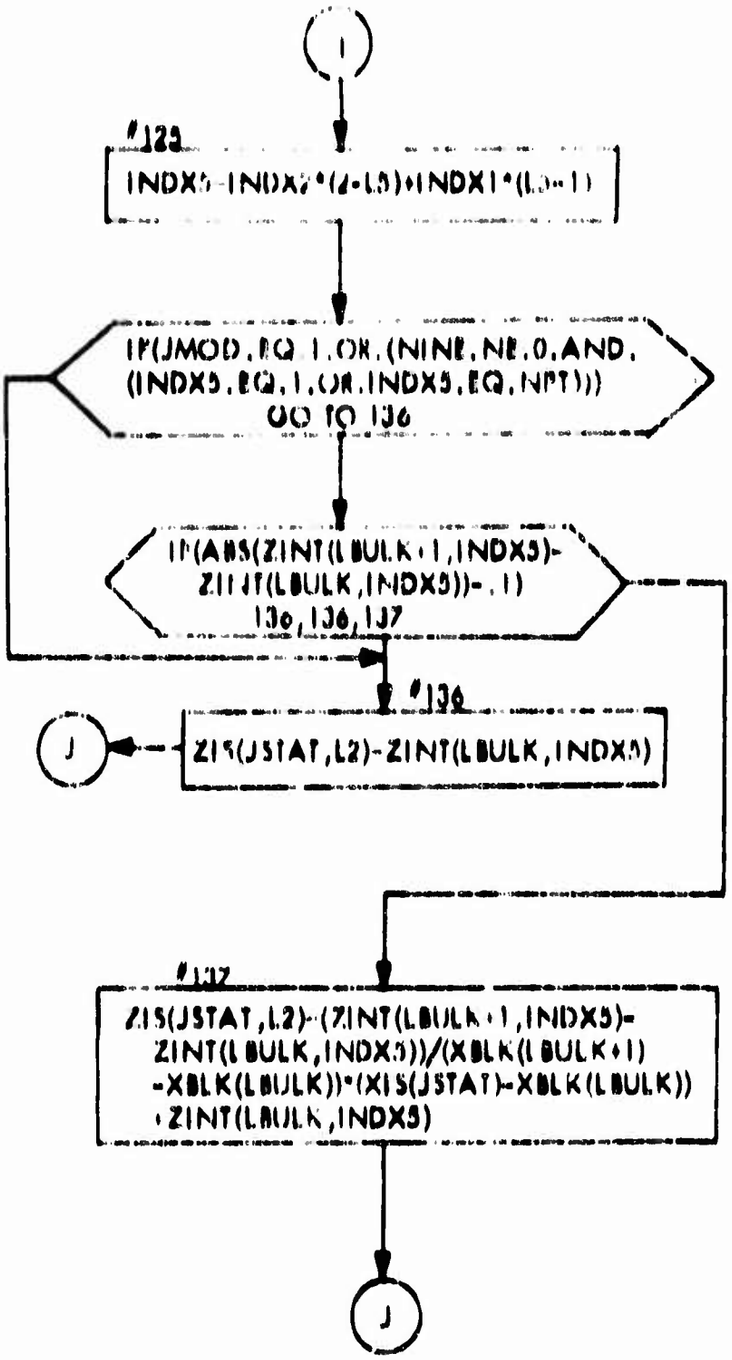
Increase index of compartment section offset table.



Search ship section breakpoint table. If any breakpoint index - index of offset just transferred, define compartment section breakpoint as index of offset in compartment section offset table (#113). Increase index of compartment section breakpoint table by 1 (L4=L4+1).

Increase index of ship breakpoint table where search will begin.

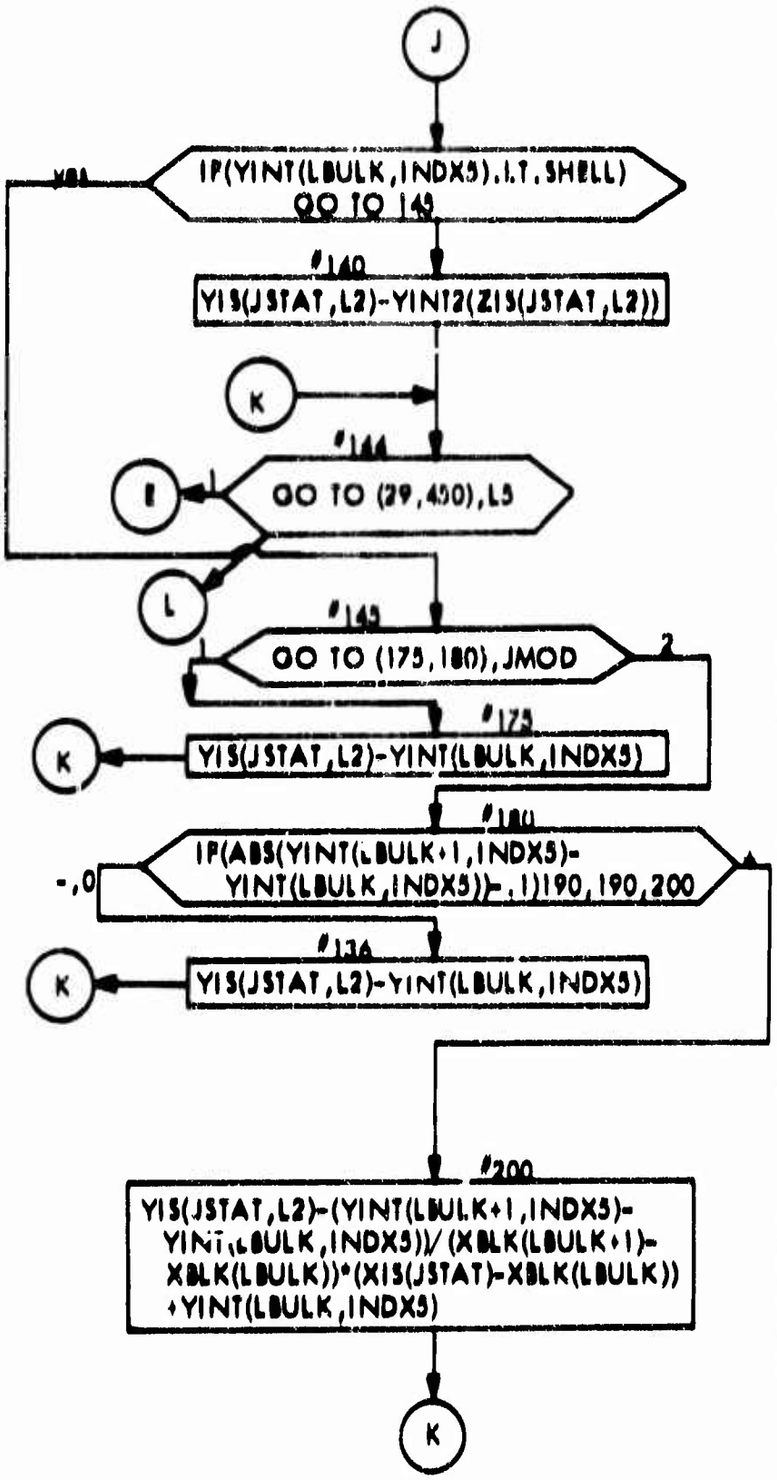
If the index of the first ship section offset to be transferred in the above DO 120 LOOP is greater than the index of the last one, no points were transferred as none lay between the two outline points. Therefore, an intermediate offset must be created in order to preserve the curvature of the section. It is taken at a point halfway (Z direction) between the two outline points, and stored in the compartment section offset table. The index of this table (L2) is then increased by 1.



Index of outline point.
See notes, #4.

If this is a bulkhead (JMOD=1), or if an intermediate station and the outline point in question is the top of either the inner or outer compartment hull and also lies on the top of the ship section, then Z of the compartment offset is the Z of the outline point. (Statement #136). Otherwise,... (for intermediate stations only), test Δ Z between the outline point on the bulkheads fore and aft of the intermediate station. If Δ Z=0, the Z of the compartment offset is the Z of the outline point.
(Statement #136)

If Δ Z$\neq$ 0, interpolate the Z of the compartment offset by a linear relationship between the Zs of the outline points on the surrounding bulkheads.
(See notes, #5)



If the outline point is within the shell, GO TO #145.

If it lies on the shell, the Y value of the compartment offset - the Y value of the shell at the Z of the outline point (use interpolation routine YINT2).

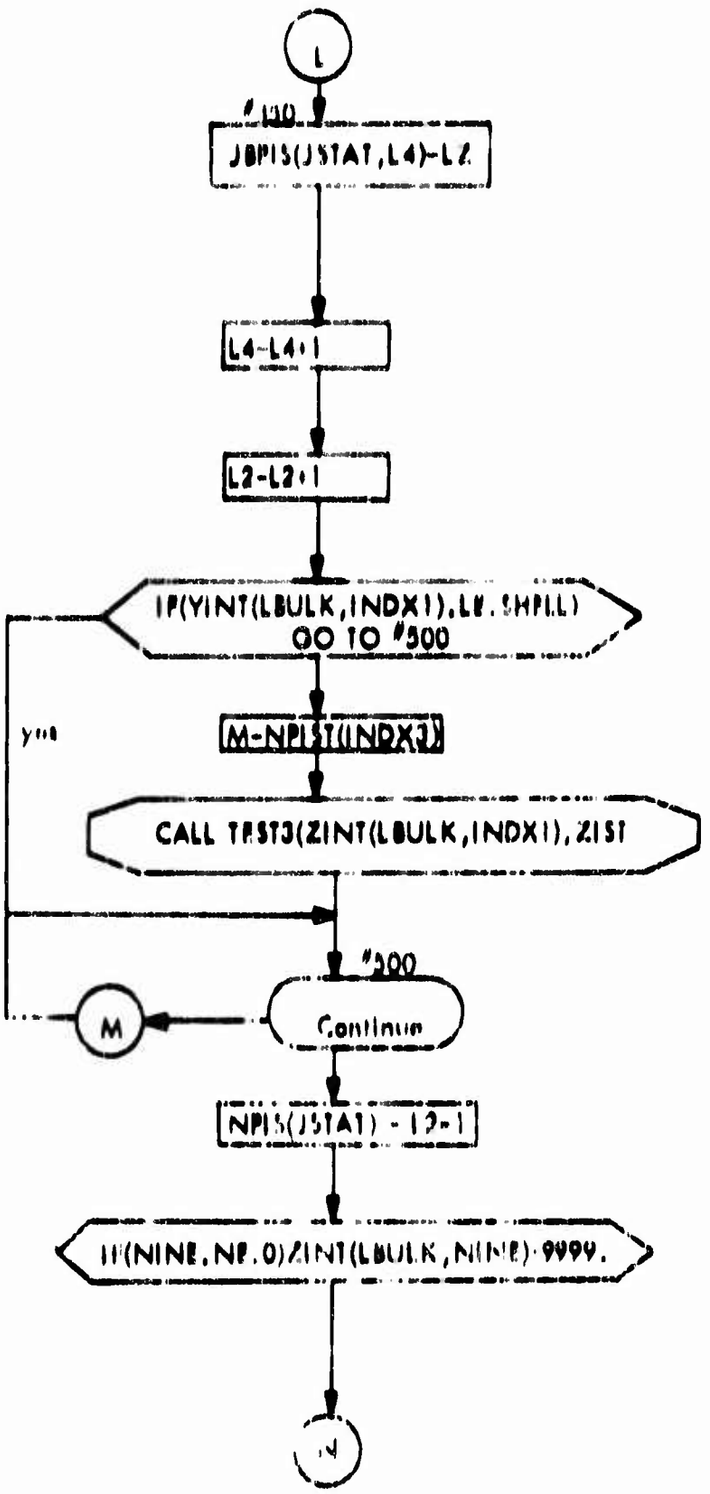
If L5-1, outline point is lowest point, GO TO #29. If L5-2 it is not, GO TO #450.

If this is a bulkhead (JMOD-1), the Y value of the compartment offset - the Y value of the outline point.

(This is an intermediate station, and the outline point lies within the shell). Test △ Y between the outline point on the bulkheads fore and aft of the intermediate station. If △ Y=0, the Y of the compartment offset is the Y of the outline point (Statement #190).

If △ Y ≠ 0, interpolate the Y of the compartment offset by a linear relationship between the Ys of the outline points on the surrounding bulkheads. (See notes, #5)

SUBROUTINE MODIFY



FLOWCHART (continued)

Store index of compartment offset in compartment breakpoint table. (offset just stored was outline point and all outline points are breakpoints).

Increase compartment breakpoint table index by 1.

Increase compartment offset table index by 1.

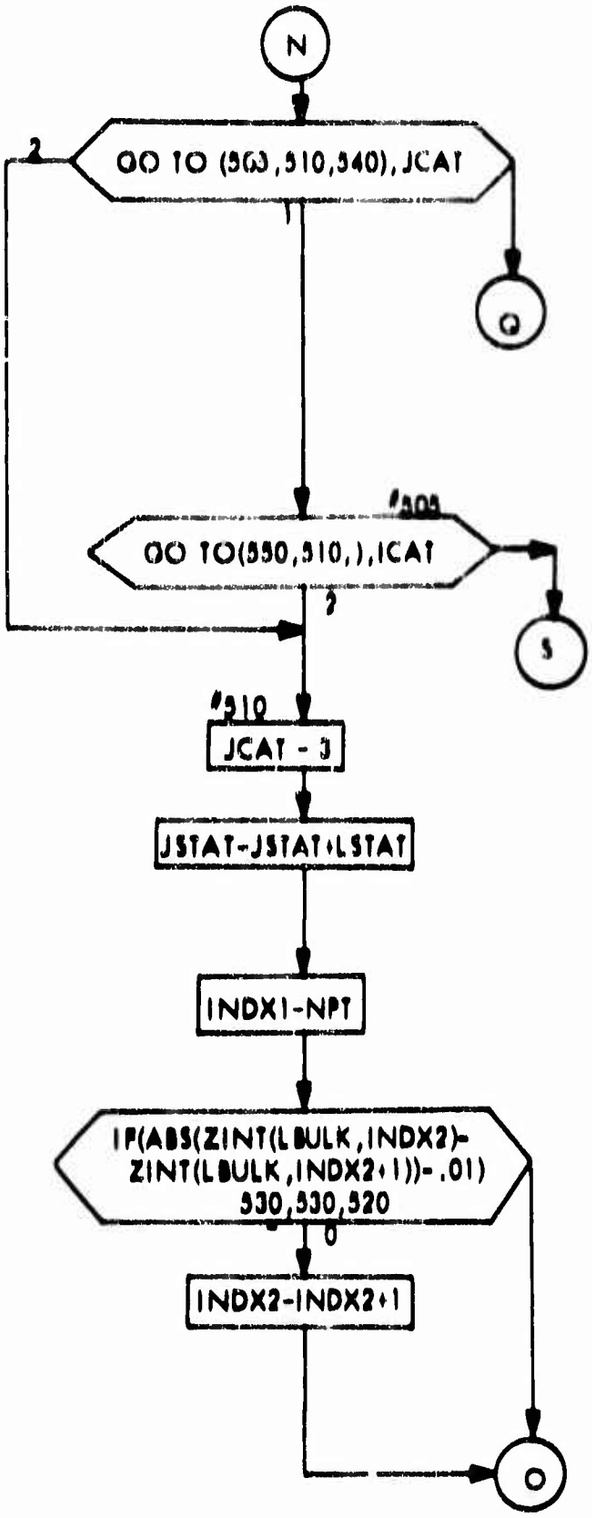
If the outline point just operated on lay within the shell, go on to the next outline point.

If it lay on the shell, find the relative location of the outline point in the ship section table of offsets. (M is the number of points on the ship section).

Go on to next outline point.

The number of points on the compartment section.

If NINE $\neq$ 0, the top outline point in the section lay on the top of the section and the actual Z value replaced the signal value of 9999.0 (See Statement #1601, page D). Restore signal value of 9999.0.



If JCAT - 1, bulkhead outline point definitions indicate single hull; GO TO #505 to test is hip has double hull. If JCAT - 2, compartment has double hull, outer hull has just been modified; GO TO #510 for inner hull initialization. If JCAT - 3, compartment has double hull, and inner hull has just been modified, GO TO #540.

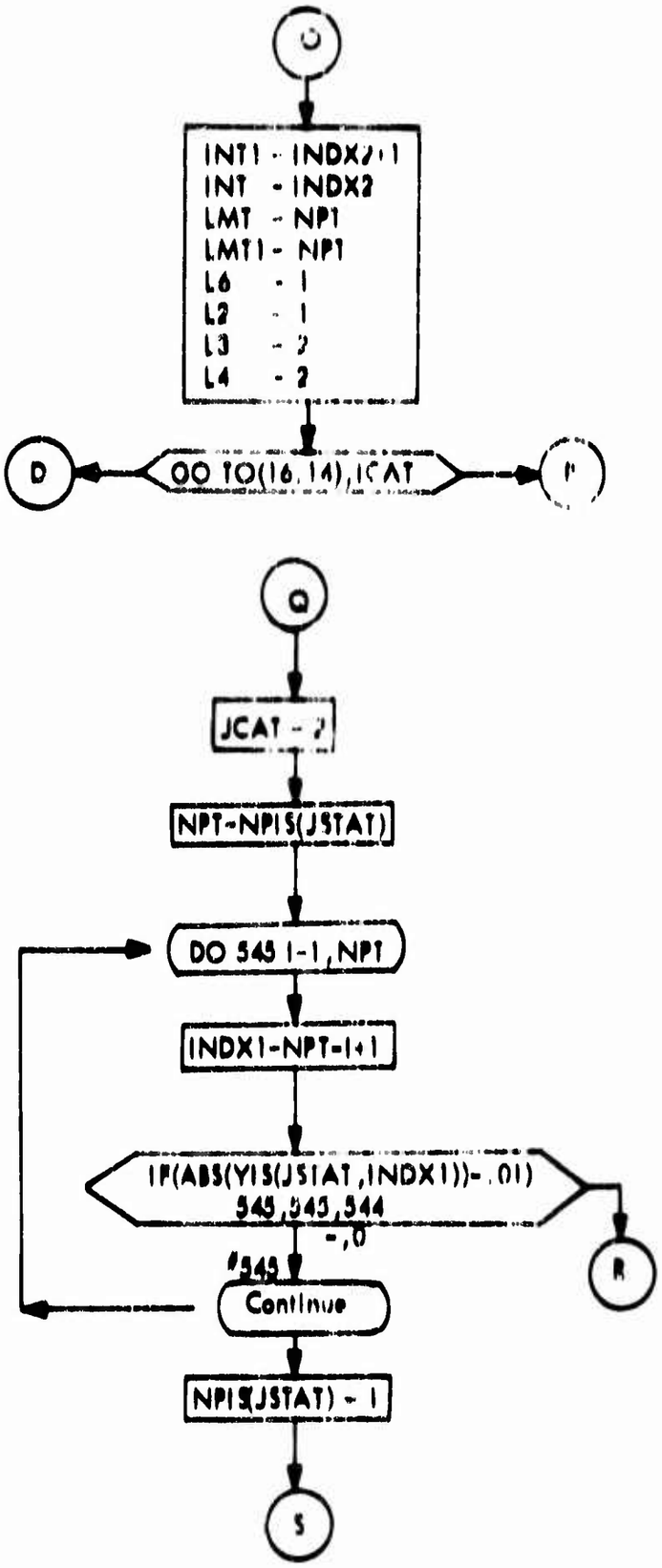
If ICAT - 1, ship has single hull; GO TO #550. If ICAT - 2 ship has double hull and therefore compartment must also have double hull; GO TO #510.

Signals modification of inner hull.

Index of inner hull - index of outer hull + number of compartment stations.

Index of outline point defining top of inner compartment section.

If $\triangle Z = 0$ between lowest outline point and next outline point, increase index of lowest outline point by 1 (to second point) (See Notes #6).



Initialization for inner compartment hull.
(See Symbol Lit)

If ICAT - 1, ship has single hull, GO TO 16. If ICAT - 2, ship has double hull, GO TO 14 to set ship hull index to inner ship hull

Reset JCAT.

Number of points on inner compartment hull.

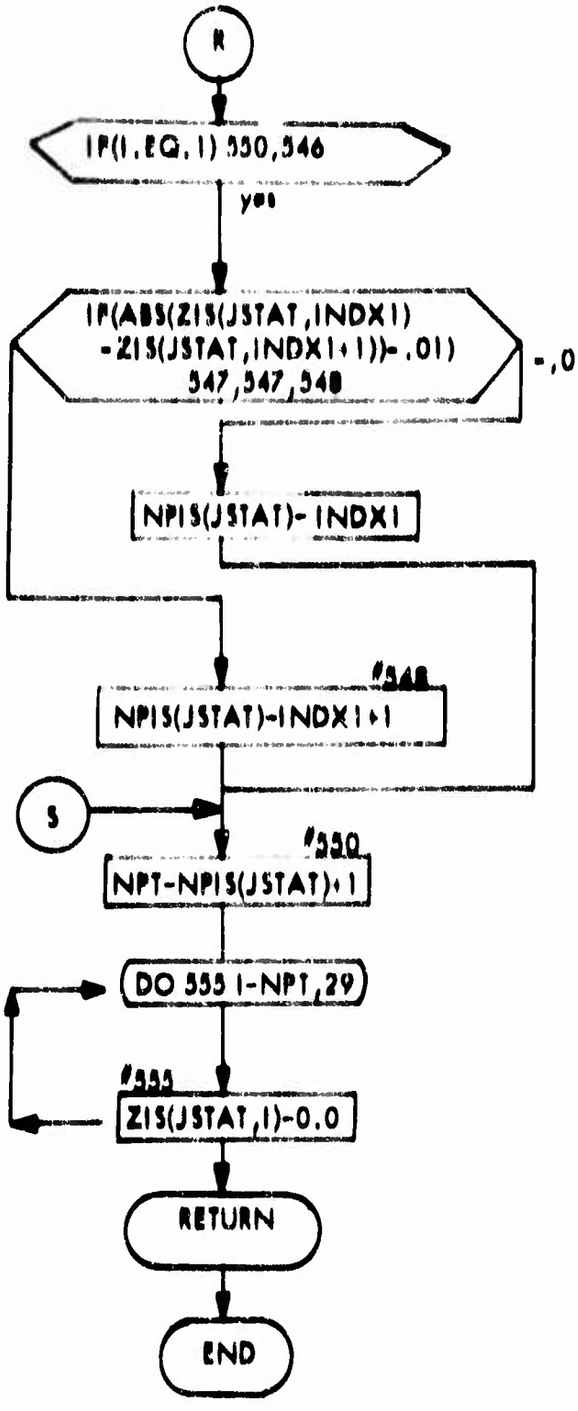
Search all points on inner hull.

Start at highest point and work down (work backwards from end of table)

If the Y of the offset is zero look at the next point, if YTS < go to R.

If all offsets have zero Y, there is effectively no inner hull. Set # of points on section inner hull to 1.

SUBROUTINE MODIFY



FLOWCHART (continued)

If offset has a Y of zero (I-1), go to #550; if there is at least one offset with a Y of zero go to #546.

If △ Z-0 between the first point of positive Y, INDX1, and the last point of zero Y, INDX1+1, the last valid point on the station is at INDX1, and therefore, the number of points on the inner compartment section equals INDX1.

(△Z-0) - the last valid point is at INDX1+1.

Set all Z above last valid point to zero.

Return to Subroutine GENERATE.

SUBROUTINE DAMAGE

1. PROGRAM DESCRIPTION:

A. General

This subroutine calculates the damage stability characteristics of the ship minus selected flooded compartments for any draft, heel, and trim condition. There is no balance of the ship; the properties are calculated at the set values of draft, heel and trim. The compartments are submitted in the same manner as the ship, namely, by a series of offsets on a minimum of 3 stations. All compartment must be submitted and their associated Compartment Data Table stored on the Ship Data Tape (LU 30) prior to execution of this routine.

B. Basic Logic

1. Input Section:

   a. The number of compartment sets (N5ET) is read in.

   b. For each set of compartments the number of compartments in the set (L), their serial numbers (L2COMP(I,J)) and permeabilities (PERMB (I,J)) are read in.

   c. The number of input trims (N4TRIM), drafts (N4DRFT), and heels (N4HEEL) are read in.

   d. If N4TRIM= 0, then the first trim - DITRIM(1) - is set equal to zero. Otherwise, the input trims are read in and the first one-DITRIM(1) is set equal to zero.

   e. The input drafts (D1DRFT(I)) are read in.

   f. The input heel angles (D1HEEL(I)) are read in.

   g. A list of the input data is printed out.

2. Calculation Section:

   a. The inter-program sentinels KW, ITEST1, and KW are defined.

   b. JSERNO is defined as
   ISERNO, the serial number of the ship.

   c. The set index I is initialized.

   d. The trim index ITRIM is initialized and the trim angle converted from degrees to radians.

   e. The draft index IDRFT is initialized.

f. The heel index 13 is initialized and the heel angle converted from degrees to radians.

g. ISERNO, the serial number of the ship or compartment being operated on, is set equal to JSERNO, the serial number of the ship.

h. The Subroutine OFFSET is called, where the Ship Data Table is read from the Ship Data Tape.

i. The Subroutine VOLUME is called where the volumetric properties of the ship are calculated.

j. The volumetric properties of the ship are stored in VISHIP, TCBISH, XLCBISH and VCBISH.

k. L is set equal to the number of compartments in set I.

l. The compartment index 14 is defined.

m. ISERNO is set equal to the serial number of compartment 14 in set I.

n. ITEST1 is set equal to 2 (this signals OFFSET that the Compartment Data Table is on the Ship Data Tape).

o. OFFSET is called where the Compartment Data Table is read from the Ship Data Tape.

p. VOLUME is called where the volumetric properties of the compartment are calculated.

q. The volumetric properties of the compartment are stored in VOLIC(14), TCBIC(14), XLCBIC(14), and VCBIC(14).

r. If all compartments in set I have been calculated, go to s; otherwise increment compartment index 14 and go to m.

s. The compartment total accumulators are set to zero.

t. The volumetric properties of the compartments in set I are summed and their individual values printed out.

u. The volumetric properties of the total flooded volume and the intact ship are printed out.

v. The flooded volume is subtracted from the intact ship and the net properties of the flooded ship are printed out. The righting arm is computed and printed out.

w. Increment heel index I3 and go back to g; if all heel angles have been calculated, increment draft index IDRFT and go back to f; if all drafts have been calculated, increment trim index ITRIM and go back to e; if all trims have been calculated, increment compartment set index I and go back to d; if all sets have been calculated, return to executive program.

II INPUT

A. COMPARTMENT DESCRIPTIONS

A.1 Method 1- Submit Compartment Offsets

Each compartment is submitted as a regular "ship" according to the instructions pertaining thereto. For each compartment a minimum of 3 stations are required. They should be submitted in accordance with data cards 1, 2, 3, 4, and 5.

Card Type 1: CC 48-50 should be punched accordingly: 000; compartment on both sides of centerline; b+1, compartment on starboard side; b-1, compartment on port side. (b represents blank).

Two restrictions exist at present on the method of compartment description which must be followed:

1. The station spacing used in describing the compartments must be identical to that of the parent ship; i.e., the station numbers on the Type 3 Data Card must be in terms of the parent ship.

2. The "LBP" on the Type 5 Data Card must be that of the parent ship, not the length of the compartment.

When the compartment description data is submitted the Type 2 Data Card should be blank - this signified that no actual major supervisors are to be executed for the compartment; only the Data Table will be formed and stored on tape.

A.2 Method 2- Submit Bulkhead Outline - See Subroutine CMPRTMNT

The compartments are identified to the damage stability routine by the serial number that appeared on the Type 1 Data Card used in their submission to the program.

Once the compartments are submitted they are stored on the Ship Data Tape and need not be resubmitted for future runs.

B. INPUT FOR DAMAGE STABILITY ROUTINE - See System Description

III Output

Table of volumes of flooded compartments VOLIC.
Vertical centers of buoyancy of flooded compartments - VCBIC.
Transverse centers of buoyancy of flooded compartments - TCBIC.
Longitudinal centers of buoyancy of flooded compartments - XLCBIC.

Total flooded volume - VOLIT.
Vertical center of buoyancy of total flooded volume - VCBIT.
Transverse center of buoyancy of total flooded volume - TCBIT.
Longitudinal center of buoyancy of total flooded volume - XLCBIT.

Volume of intact ship - VISHIP.
Vertical center of buoyancy of intact ship - VCBISH.
Transverse center of buoyancy of intact ship - TCBISH.
Longitudinal center of buoyancy of intact ship - XLCBSH.

Volume of damaged ship - VOLIT.
Displacement of damaged ship - DSPL.
Vertical center of buoyancy of damaged ship - VCBIT.
Transverse center of buoyancy of damaged ship - TCBIT.
Longitudinal center of buoyancy of damaged ship - XLCBIT.
Righting arm of damaged ship - ROTARM.

NOTE: Flooded volumes are actual volumes x input permeabilities.

FUNCTION YINT2(TEST)

This program is identical to WPLAN1 except for the following items:

1) YINT2(TEST) is called as a function subprogram rather then as a subroutine.

2) The test value of draft at which the halfbreadth is desired is now included in the calling statement as TEST, rather than stored in COMMON.

3) The following array and variables have been replaced as indicated* (for description of the meaning of the different arrays see the documentation for subroutine MODIFY):

ZIST---▶Z
YIST---▶Y
YINT---▶YI(ISTAT)
L----▶M
IBREA---▶IBREAK
INDX3---▶ISTAT
JBPST-----▶JBREAK

4) The function FINTP2 is now written out explicitly.

5) For further details see NavShips 0900-006-5810.

*The symbol"---▶" means "replaces".

SUBROUTINE TEST3

This subroutine is similar in logic and objective to Subroutine TEST1 of the original Ship Hull Characteristic Program, namely, the determination of the relative position of a test value with respect to a table of sequential numbers. It is used for locating bulkhead outline points on the ship section.

Two sentinels are OUTPUT:

K: A sentinel indicating the status of the test value with respect to the array defined follows:

K = 1 the value of TEST is less than the maximum value in the array.
K = 2 the value of TEST = a value in the array.
K = 3 the value of TEST lies between 2 values in the array (indices NWP and NWP+1).

NWP: The index in the array of the value in array corresponding to TEST(K-2), or the first value less than TEST(K-3).

For further details see NavShips 0900-006-5750 where the following arrays and variables have been replaced as indicated:

NPT---▶M
INDX3---▶ISTAT

PROGRAM MODIFICATION TO SHCP (YOHULL)

I For Double Offset Modification.

A. The following changes must be made to DIMENSION variables in all programs:

1. All variables with a subscript 15 must have the first dimension which is 30 changed to 60.

2. All variables ending in 25 must have their dimension changed from 30 to 60.

3. The following draft variables must also have their dimensions increased from 30 to 60: H, H1HOO, H1MAR and H1SAO.

4. The first dimension of JBREAK shall be increased from 30 to 60 and the first dimension of the variables S shall be increased from 30 to 60.

5. The first dimension of the variables Y and Z shall be increased from 30 to 60.

6. The dimension of the variables X, NP, STATNO and Y1 shall be increased from 30 to 60.

7. Y1INT(4,30) shall be added to DIMENSION.

B. The following variables shall be added to COMMON: ICAT, LIMIT and Y1INT.

The following is a list of required program modifications, referenced by the card numbers that occur in the program listings in the individual program write-ups.

C. Hull Characteristics Executive Program NavShips 0900-006-5600

```
      IIISYM,ICAT                                          Hull0810
      ILBP,XMID,JDUMMY,LIMIT                               Hull0850
1320  DO 1141 ISTAT=1,LIMIT                                Hull0870
      ILBP,XMID,JDUMMY,LIMIT                               Hull0940
      DO 5462 ISTAT=1,LIMIT                                Hull0950
      IF(ICAT-2)728,1289,1289                              Hull1610
 728  KW=1                                                 Hull1611
1289  IPROG=1                                              Hull1860
      IIISYM,ICAT                                          Hull3990
```

D. Subroutine OFFSET NavShips 0900-006-5720

```
      DO 1756 ISTAT=1,60                                   OFFS0740
      IBP,XMID,JDUMMY,LIMIT                                OFFS0830
 319  DO 330 ISTAT=1,LIMIT                                 OFFS0910
 140  DO 141 ISTAT=1,LIMIT                                 OFFS0940
      ICAT=JDUMMY                                          OFFS0991
      IF(ICAT-2)333,334,335                                OFFS1771
 334  ICAT=3                                               OFFS1772
      ISTAT=ISTAT+1                                        OFFS1773
      LIMIT=2*NSTAT                                        OFFS1774
      GO TO 10                                             OFFS1775
 335  ICAT=2                                               OFFS1776
      NSTAT=NSTAT/2                                        OFFS1777
      GO TO 346                                            OFFS1778
 333  LIMIT=NSTAT                                          OFFS1779
 346  DO 411 ISTAT=1,LIMIT                                 OFFS1780
      DO 851 ISTAT=1,LIMIT                                 OFFS2110
      ILBP,XMID,ICAT,LIMIT                                 OFFS2400
      DO 190 ISTAT=1,LIMIT                                 OFFS2410
      DO 860 ISTAT=1,LIMIT                                 OFFS2690
```

E. Subroutine HYDRO NavShips 0900-006-5700

```
      ILIMIT=LIMIT                                         HYDR1681
 890  LIMIT=ILIMT                                          HYDR1860
      RETURN                                               HYDR1861
```

F. Subroutine AREAS NavShips 0900-006-5700

```
      I2=ISTAT                                             AREA0799
      GO TO(3110,889,890),ICAT                             AREA3300
 889  YIINT(I,ISTAT)=Y55(I)                                AREA3301
```

```
      GO TO 3110                                                    AREA3302
  890 I1=ISTAT-NSTAT                                                AREA3303
      YIINT(3,I1)=Y3S(1)                                            AREA3304
      GO TO 3110                                                    AREA3305
      IF(ICAT-2)777,778,779                                         AREA3384
  778 S1=S2S(ISTAT)                                                 AREA3385
      AREA=AREA2S(ISTAT)                                            AREA3386
      TCO=TCO2S(ISTAT)                                              AREA3387
      VCO=VCO2S(ISTAT)                                              AREA3388
      IF(ABSF(THETIH)-.0001)667,667,668                             AREA3389
  668 YIINT(2,ISTAT)=Y3S(2)                                         AREA3390
  667 ICAT=3                                                        AREA3391
      ISTAT=ISTAT+NSTAT                                             AREA3392
      GO TO 222                                                     AREA3393
  779 VCO2S(I2)=(VCO*AREA-VCO2S(ISTAT)*AREA2S
                    (ISTAT))/-AREA2S(IS                             AREA3394
     ITAT))                                                         AREA3395
      TCO2S(I2)=(TCO*AREA-TCO2S(ISTAT*AREA2S(ISTAT))/
                    (AREA+AREA2S(IS                                 AREA3396
     ITAT))                                                         AREA3397
      AREA2S(I2)=AREA-AREA2S(ISTAT)                                 AREA3398
      S2S(I2)=S1+S2S(ISTAT)-2.0*S(ISTAT,L)                          AREA3399
      ICAT=2                                                        AREA3400
      IF(ABSF(THETIH)-.0001)664,664,665                             AREA3401
  665 YIINT(4,ISTAT)=Y3S(2)                                         AREA3402
  664 ISTAT=ISTAT-NSTAT                                             AREA3403
```

PROGRAM MODIFICATION TO SHCP (YOHULL)
(continued)

II Modifications for incorporation of Subroutines DAMAGE & CMPRTMNT

The following is a list of required modifications to SHCP, referenced by the card number that occur in the program listings in the individual program write-ups:

A. Hull Characteristics Executive Program NavShips 0900-006-5600

```
      1BP,XMID,JDUMMY,LIMIT,KDUMMY                                HULL0850
      1LBP,XMID,IDUMMY,LIMIT,KDUMMY                               HULL0940
   62 GO TO (20,70,90,3999,3999,1142,40,95)                       HULL1890
   95 CALL CMPRTMNT                                               HULL3775
      GO TO 60                                                    HULL3776
  300 GO TO (330,340,350,360,370,380,390,500),ITEST1              HULL3820
  390 CALL DAMAGE                                                 HULL3971
      IPROG=IPROG+1                                               HULL3972
      GO TO 140                                                   HULL3973
```

B. Subroutine OFFSET NavShips 0900-006-5720

```
      1BP,XMID,JDUMMY,LIMIT,KDUMMY                                OFFS0830
      11SYM=KDUMMY                                                OFFS0992
      1LBP,XMID,ICAT,LIMIT,11SYM                                  OFFS2400
      WRITE(30) IEOP,NAME,NSTAT,NP,XLBP,XMID                      OFFS2470
      ICAT,LIMIT,11SYM
```

DATA PREPARATION

The required input for the Hull Characteristics Program depends upon which major subroutines are desired to be executed. The Card Type Usage Map on the following page indicates the required card types for each of the major subroutines. A particular card type may require more than one card and this fact is indicated in the input description.

For any one run of a ship only one of each pertinent card type may be submitted. Start at the highest number program being called and work back, adding those card types required for other called programs not required by any higher called program.

Only one card Type E is required per run, regardless of the number of ships being run. It is placed at the end of the data deck.

Cards type 9, 10, and 14 are optional - see card type descriptions.

Data cards for any computer run are submitted in ascending order by card type number, except for Card Types 25 through 35. See System Description, pages 2 and 3 of this report, for details.

CARD TYPE USAGE MAP

PROG. NO.	PROGRAM \ CARD TYPE	1	2	3	4	5	6	7	8	9
1	HYDROSTATICS & BONJEANS	▲	▲	▲	▲	▲	▲	▲	▲	▲
2	DERIVE A NEW HULL FORM FROM A PARENT	▲	▲	▲	▲	▲	▲			
3	LONGITUDINAL STRENGTH	▲	▲	▲	▲	▲	▲			
4	FLOODABLE LENGTH	▲	▲	▲	▲	▲	▲			
5	LIMITING DRAFTS	▲	▲	▲	▲	▲	▲			
6	INTACT STABILITY	▲	▲	▲	▲	▲	▲			
7	COMPARTMENT GENERATION	▲	▲	▲	▲	▲	▲			
8	DAMAGE STABILITY	▲	▲	▲	▲	▲	▲			

***Once the offsets and LBP are submitted they are stored on the Ship Data Tape as part of the Ship Data Table; therefore, card types 3, 4, and 5 must be submitted only once for each ship, thereafter, only those card types pertaining to the called programs should be submitted for any run (see Card Type 1). However, if the offsets are changed, the ship must be given a new serial number and the offsets resubmitted.

* Last CD of this type must be a 999 (13) CD.

CARD TYPE	Card Column	Input Format	Program Symbol	Definition	Remarks
1 Ship Identification (one card)	1-4 5-36 37-44 45-47 48-50 51-53 54-56	I4 8A4 2A4 I3 I3 I3,X2 I3	ISERNO NAME IS DATE ITEST1 IDUCT IDSYM ICAT	Ship serial number Ship name or title Date of program run A sentinel (See Remark no. 1) {1 IF FIRST CARD OF HULL TYPE {0 ALL OTHER TYPES {+1 SYMMETRICAL SIDE ONLY {-1 PORT SIDE ONLY {0 SYMMETRICAL ABOUT ℄ {1 SINGLE HULL {2 DOUBLE HULL	1. Submit the number 1 when offsets are being submitted. Submit the number 2 when offsets are to be read from the Ship Data Tape. 2. All ships are identified to the system by a serial number. This number is assigned when the ship is initially submitted and is used thereafter whenever the ship is run. If the offsets are changed, the ship must be given a new serial number and resubmitted. 3. One card of this type required.
2 Program Identification (one card)	1-3 4-6 7-9 etc. 25-27	I3 I3 I3 I3 I3	KP (see remark 1.) KK (see remark 2.)	Identification numbers of the programs to be run A sentinel	1. Submit 001 for Hydrostatics and Bonjeans Submit 003 for Longitudinal Strength Submit 004 for Flooding Length Submit 005 for Limiting Draft Submit 006 for Intact Stability Submit 007 for Damage Stability Submit 008 for Compartment Generation 2. Submit 000 for printout of Ship Data Table values of interpolated areas, WCG, TCG, GIRTH, X, Y, Z. Submit 001 if these values are not to be printed out. 3. One card of this type is required.
3 Scale Data (one card)	1-10 11-20 21-30	F10.3 F10.3 F10.3	SPACE1 ZSCALE YSCALE	Station spacing (LBP/stn. no. at AP) Scale of drawing in vertical direction (inches per foot) Scale of drawing in horizontal direction (inches per foot)	1. Offset data is assumed to be from the tele-comtor which gives values in counts. 200 counts equals one inch of plot. The program converts these counts to feet. Therefore, if offsets are submitted in decimal feet, ZSCALE and YSCALE should be entered as 0.005. 2. One card of this type is required.

CARD TYPE	Card Column	Input Format	Program Symbol	Definition	Remarks
4 Offset Data (one card per offset)	1-6 7-13 14-20 21-36	F6.3 F7.0 F7.0 E	STATNO Y Z ITEST1	Station number (distance from FP/station spacing) Half breadth Distance above/below baseline (+/-) A sentinel identifying the offset point (See Remark No. 1)	1. Submit [illegible] for each breakpoint Submit [illegible] for the last point on the station Submit 999999 for the last point on the last station Submit 900000 for all other offsets 2. The station number is minus for all stations forward of the FP. 3. Offsets are to be submitted by stations, with points in order from the baseline to the deck edge. 4. A separate card is required for each offset
5 Ship Data (one card)	1-10	F10.3	LBP	Length between perpendiculars	1. Only one card of this type is required
6 Ship Data (one card)	1-10 11-20 21-30 31-40	F10.3 F10.3 F10.3 F10.3	XLCG VOLID HBASC TRIM	Design LCG (in feet from amidships, + fwd, - aft) Design displacement (in tons) Design draft (in feet above baseline at amidships) Design trim (total trim in feet, + down by bow, - down by stern)	1. Only one of the following combinations of two fields are to be submitted: VOLID and XLCG VOLID and TRIM HBASC and TRIM 2. Those fields not used must be filled with zeros (0's) 3. One card of this type is required
7 Hydrostatics and Bonjeans (one card)	1-3 4-7 8-10	I3 I3 I3	NWL NTRIM NSHEEL	Number of output waterlines (See Remark No. 1) Number of output trims NUMBER OF OUTPUT HEELS (Zero or blank, max 4) (See remark #3 →) Heels ship to port	1. The minimum number of waterlines is nineteen (19) 2. The minimum number of trims is six (6) 3. If Hydrostatics are desired only at zero trim, no output trims need be submitted. If other trims are desired, only those other than zero trim need be submitted 4. One card of this type is required

CARD TYPE	Card Column	Input Format	Program Symbol	Definition	Remarks
8 Hydrostatics and Bodyforces (one card per [illegible])	1–10	F10.2	EDOUT	Distance of the output waterline above or below the baseline (in feet)	1. Submit a separate card of this type for each output waterline. The maximum number is nineteen (19), see remark 1, card type 7.
9 Hydrostatics and Bodyforces (one card per trim)	1–10	F10.2	TRIMO	Output trim (in feet)	1. Submit a separate card of this type for each output trim. The maximum number of cards permitted is six (6), see remark 2, card type 7.
10	1– 10	F10.2	THETSN	Output Heel (in degrees)	1. One card / weight heel, max = 4; See remark #2, Card Type 7.
11	This card type reserved for future use.				
12 Longitudinal Strength (one card)	1–5 6–10 11–15 16–20 21–25 26–30 31–35 36–40 41–45 46–50	I5 F5.2 F5.2 F5.2 I5 F5.2 I5 F5.2 I5 F5.2	NSTATS HWI WAVCEN XLAMDA IWH WHINC IWL WLINC IWC WCINC	Number of weight stations Sentinel for wave height (See Remark No. 7) Distance of wave center from midships (+ fwd, – aft) Ratio of λ/LBP Number of wave heights Wave height increment (See Remark No. 2) Number of wave lengths Wave length increment (See Remark No. 3) Number of wave centers Wave center increment (See Remark No. 4)	1. Submit 0 for 1.1 $\sqrt{LBP}$ wave height Submit 1 for LBP/20 wave height 2. Expressed as a decimal fraction of wave height 3. Expressed as a decimal fraction of LBP 4. Expressed as a decimal fraction of wave length 5. One card of this type required

CARD TYPE	Card Columns	Input Format	Program Symbol	Definition	Remarks
13 Longitudinal Strength one card	1–10 11–20 21–30 31–40	F10.3 F10.3 F10.3 F10.3	XLCG WEIGHT XLCGSW SECTSW	Distance of the cent of weight station from FP in feet Weight in the weight station in tons LCG of weight station from midship in feet (+ fwd, – aft) This space reserved for section modulus	1. Card for weight aft of AP must be submitted regardless of whether or not weight is there. In any case XCG should be left blank if no weight whole card is blank. XCG for next to last card must be equal to XLBP. That is next to last WT stn. must be exactly at AP 2. Submit one card for each weight station.
14 Flexible Length one card per station	1–7 8–17	F7.3 F10.2	STAT BKHAR	Station number (See Remark No. 1) Height of margin line above baseline at station 'STAT' in feet (See Remark No. 2)	1. Station number must be an input station. 2. The margin line is automatically set by the program at 3' below the uppermost 'Z' offset height of the station. These Data Cards are used only when it is desired to use a margin line other than the present one in which case cards must be submitted only for those stations changed.
15 Flexible Length one card	1–7			Control card for flexible length and bending data	1. Submit 9's in specified field. 2. One card of this type required.
16 Flexible Length one card	1–3	I3	NPERM	Number of permeabilities	1. One card of this type required.
17 Flexible Length one card for each permeability	1–10	F10.2	PERM	The permeability	1. Submit one card for each permeability.

CARD TYPE	Col Column	Input Field	Program Symbol	Definition	Remarks
18	1	[redacted]	[redacted]	[redacted]	1. This card is for the forward component 2. A component may appear more than once 3. A combination of these groups may be used in any order 4. If there is no forward component, group 1 is blank 5. One card of this type is required
	2-10	BLANK			
	11-12			Group 1	
	13-14			Group 2	
	15-16			Group 3	
19	1	[redacted]	[redacted]	[redacted]	1. This card is for the aft component 2. If there is no aft component, this card is blank 3. Input is in card type 18 order 4. One card of this type is required
	2-10	BLANK			
	11-12			Group 4	
	13-14			Group 5	
	15-16			Group 6	
20	1	[redacted]	[redacted]	[redacted]	1. Input is in same order as the component data on the FP coding card
	2	BLANK			
	3-12		NAVSEC	Identification number of the component	
	13-14		DDAMD	Distance of the forward end of the component from the FP	
	15-16		DDAMD	[redacted] of the aft end of the component from the FP	
	17-20		PERD	[redacted]	
21	1	[redacted]	[redacted]	[redacted]	1. Input is in same order as the component data 2. One card of this type is required
	2-10	BLANK			
	11-12			Coded card for coding data	

CARD TYPE	Card Column	Input Format	Program Symbol	Definition	Remarks
22	1-3	I3	NDISPL	Number of displacements/diradii (See remark No. 1)	1. Submit 4 if displacements are given; submit 5 if diradii are given.
	4-5	I2	IDISPL		2. A maximum of five displacements are permitted.
Input Stability	6-15	F10.5	VOL 5 (1)	Displacements in feet or Diradii in feet	3. One card of this type required.
	16-25	F10.5	VOL 5 (2)		
	26-35	F10.5	VOL 5 (3)		
	36-45	F10.5	VOL 5 (4)		
(one card)	46-55	F10.5	VOL 5 (5)		
23	1-3	I3	NLCG	Number of LCG's/trims Punch 0 or 1 (See remark No. 2).	1. Submit 0 if LCG's are given Submit 1 if trims are given.
	4-5	I2	ILCG		2. A maximum of 5 LCG's may be specified.
Input Stability	6-15	F10.5	XLCG5 (1)	LCG's in feet from amidships (+ fwd, - aft) OR, trims in feet (+ down by bow, - down by stern)	3. One card of this type required.
	16-25	F10.5	XLCG5 (2)		
	26-35	F10.5	XLCG5 (3)		
	36-45	F10.5	XLCG5 (4)		
(one card)	46-55	F10.5	XLCG5 (5)		
24	1-3	I3	NHEEL	Number of angles of heel	1. A maximum of 10 angles of heel may be specified.
	4-5	BLANK			2. One card of this type is required.
	6-12	F7.5	THETA(1)	Angles of heel in degrees	
Input Stability	13-19	F7.5	THETA(2)		
	20-26	F7.5	THETA(3)		
	27-33	F7.5	THETA(4)		
	34-40	F7.5	THETA(5)		
(one card)	41-47	F7.5	THETA(6)		
	48-54	F7.5	THETA(7)		
	55-61	F7.5	THETA(8)		
	62-68	F7.5	THETA(9)		
	69-75	F7.5	THETA(10)		

CARD TYPE	CARD COLUMN	INPUT FORMAT	PROGRAM SYMBOL	DEFINITION	REMARKS
25 Compartment Generation (one card)	1–5	I5	NCOMP1	Number of Compartments	
26 Compartment Generation (one card per compartment)	1–4 5–36 37–44 51–53 54–56	I4 8A4 2A4 I3 I3	ISBINO NAMEIS DATE IISYM NBULK	Compartment serial no. Compartment name Date -1 starboard side only -1 port side only 0 symmetrical about $\mathcal{C}_L$ See Subroutine CMPRTMNT Number of bulkheads	 (maximum: 4)
27 Compartment Generation (See Page 2 sequence)	1–5 6–15	I5 F10.2	NINT(I) XBLK( )	Number of outline points on the bulkhead distance of the bulkhead from the F.P. in feet	(maximum: 10)
28 Compartment Generation (See Page 2 for card sequence)	1–10 11–20	F10.2 F10.2	ZINT(I, IPT) YINT(I, IPT)	Z of outline point Y of outline point	Maximum of 10 points

CARD TYPE	CARD COLUMN	INPUT FORMAT	PROGRAM SYMBOL	DEFINITION	REMARKS
29 Damage Stability (one card)	1–5	I5	NSET	Number of sets of compartments	(maximum=20)
30 Damage Stability (See Page 3 for card sequence)	1–4	I4	L(CO[illegible]P (I)	[illegible]er of compartments in the set	(maximum=25)
31 Damage Stability (See Page 3 for card sequence)	1–80	10(4,F4.2)	L2COMP (I,J) PERMB (I,J)	Serial number of compartments in the set and associated permeabilities	Data in order by serial number, perm, serial number, perm., etc. maximum of 10 compartments/ card
32 Damage Stability (one card)	1–5 6–10 11–15	I5 I5 I5	N4TRIM N4DRFT N4HEEL	Number of trims Number of drafts Number of heels	(maximum=3) (maximum=8) (maximum=10) If no trims other than zero are desired, N4TRIM = 0
33 Damage Stability (one card/ trim)	1–10	F10.3	DITRIM	Trim angle in degrees	(maximum=3) See card type 32. If no other trim other than zero are desired, this card should be ignored

CARD TYPE	CARD COLUMN	INPUT FORMAT	PROGRAM SYMBOL	DEFINITION	REMARKS
34 Damage Stability (one card/draft)	1–10	F10.3	DIDRFT	Drafts above baseline in feet	(maximum:8) See card type 32
Damage 35 Stability (one card/heel)	1–10	F10.3	DIHEEL	Heel angle in degrees	(maximum:10) See card type 32 Angle sign: +, heel to port, – heel to starboard
E	1–4	I4	9999	End of Job	

MACHINE REQUIREMENTS AND CONTROL CARDS

This version of the Ship Hull Characteristics Program is written in Fortran IV for execution on the Control Data Corporation 3600 System.

Core required for the system is 32,530 words (decimal) consisting of 16,686 words for common storage and 15,844 words for the programs.

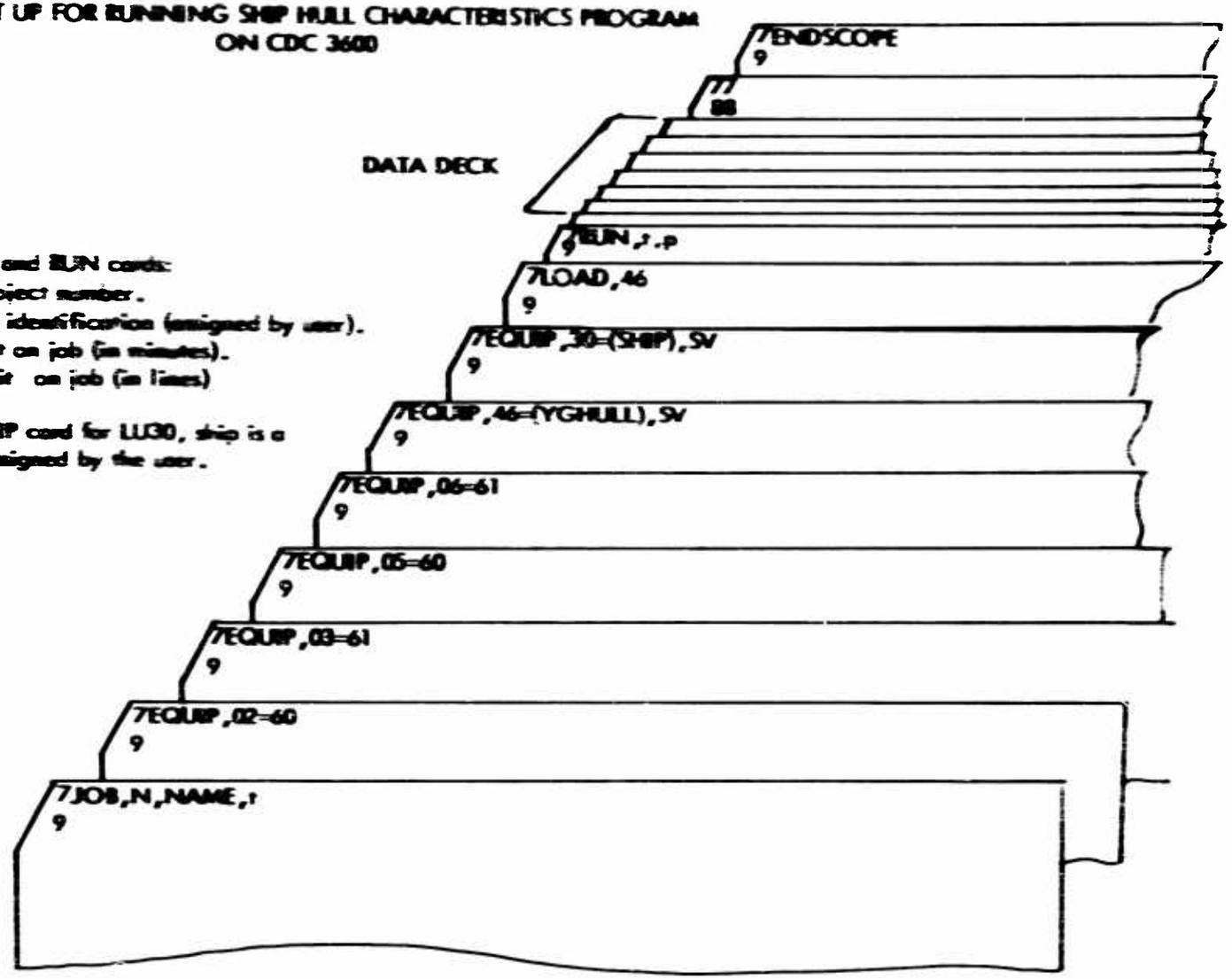
To run the system on other than CDC equipment, compare the following Fortran statements in CDC Fortran IV to those on the considered equipment.

1. DATA

2. CDC Fortran IV permits variable names up to 8 characters; the only cases of names longer than 6 characters in the system are Subroutine GENERATE and its call in CMPRTMNT, Subroutine CMPRTMNT and its call in YGHULL, and the variable GUNWHALE in Subroutine MODIFY.

The card check set up for running on the CDC 3600 is illustrated on the following page.

DATA DECK SET UP FOR RUNNING SHIP HULL CHARACTERISTICS PROGRAM
ON CDC 3600



Note

1. On the JOB and RUN cards:
   N = CDC project number.
   NAME = job identification (assigned by user).
   t = time limit on job (in minutes).
   p = print limit on job (in lines)

2. On the EQUIP card for LU30, ship is a tape label assigned by the user.

SHIP SER. NO. 0515 SHIP NAME- DEC SHIP 15

COMP. CP. NO. 152 COMP. NAME- STORE-SHIP SIDE

COMPARTMENT SECTION DEFINITION-

NOTE- VINT= 9999 REJECTS ALL INTERSECTION
ZINT= 9999 REJECTS TOP OF SHIP HULL
ZINT=-9999 REJECTS BOTTOM OF SHIP HULL

HULL=232.0		HULL=256.0		HULL=	
ZINT	YINT	ZINT	YINT	ZINT	YINT
9999.0	9999.0	9999.0	9999.0		
0.0	9999.0	0.0	9999.0		
0.0	0.0	0.0	0.0		
9999.0	0.0	9999.0	0.0		
9999.0	9999.0	9999.0	9999.0		

NOTE- ASTERISK REJECTS BREAKPOINT

SHIP SECTION 210.00 FT FROM FP			COMPART. SECTION 232.30 FT FROM FP			DATE= HULL
Z		Y	Z		Y	
-0.30	*	1.00	0.00	*	18.76	
1.85		7.44	10.00		25.59	
4.00		14.20	13.00		21.85	
6.00		19.00	16.20		22.33	
8.00		20.90	20.50		22.77	
10.35		22.83	25.30	*	23.00	
12.70	*	22.60	0.00		3.00	
10.05		22.00	0.00		3.00	
25.00	*	23.00	0.30		3.00	

SAMPLE OUTPUT- (MACTHM(007)

SHIPBUILDING AUTOMATION NAVAL ENGINEERING

SAMPLE OUTPUT - CRIMETHOT (003)

SHIP SECTION
265.00 FT FROM FP

Z		Y
-4.50	•	1.00
0.75		1.40
2.00	•	1.75
4.00		7.40
6.00		12.10
8.00		16.30
10.00		18.90
13.00		21.40
16.00		21.40
20.50		22.46
25.00	•	23.00

COMBAT. SECTION
265.00 FT FROM FP

Z		Y
0.00	•	16.30
10.00		16.40
13.00		21.40
16.00		21.40
20.50		22.46
25.00	•	23.00
0.00		0.00
0.00		0.00
0.00		0.00
0.00		0.00
0.00		0.00

SHIP SECTION
280.00 FT FROM FP

Z		Y
-1.00	•	1.00
3.15		1.85
7.30	•	2.70
8.65		7.56
16.00		11.30
13.00		17.75
16.00		20.00
20.50		22.17
25.00	•	23.30

COMBAT. SECTION
280.00 FT FROM FP

Z		Y
0.00	•	13.55
10.00		16.95
13.00		21.22
16.00		21.42
20.50		22.56
25.00	•	23.00
0.00		0.00
0.00		0.00
0.00		0.00
0.00		0.00
0.00		0.00

SHIP- STANDARD SHIP SIZE SERIAL NUMBER 1532 DATE-07/07/67

SAMPLE OUTPUT - COPYRIGHT (007)

SHIP DATA TABLE

THE FOLLOWING PAGES CONTAIN THE SHIP DATA TABLE OF INTERPOLATED OFFSETS AND COMPUTED SECTIONAL AREAS, VCBS, HALF SECTION TCBS, AND HALF SECTION BIRTHS. THE TABLE IS THE OUTPUT OF SUBROUTINE TABLE.

DEFINITIONS AND UNITS ARE AS FOLLOWS.
Z - HEIGHT IN FEET ABOVE BASELINE
Y - HALF BREADTH IN FEET
AREAS - FULL SECTION AREA IN SQUARE FEET

VCBS - VERTICAL CENTER OF GRAVITY OF SECTION AREA ABOVE BASELINE IN FT.
TCB - TRANSVERSE CENTER OF GRAVITY OF HALF SECTION AREA MEASURED FROM THE CENTERLINE IN FT.
BIRTH - HALF SECTION BIRTH IN FT.

[illegible]

TABLE OF INTERPOLATED OFFSETS FOR COMPUTED SECTIONAL [illegible]

SAME SHIP - CHANGE (837)

STATION [illegible] LOCATED [illegible] FT FROM FP

Z	Y	AREA	ACS	TCS	-I-I-
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13.000	21.954	217.165	18.563	10.379	28.941
14.750	22.423	373.425	12.446	17.691	28.956
20.500	22.748	442.837	14.045	15.843	32.344
22.750	22.918	645.733	15.955	12.[illegible]	30.575
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STATION [illegible] LOCATED [illegible] FT FROM FP

Z	Y	AREA	ACS	TCS	-I-I-
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18.500	19.406	49.885	9.296	9.029	28.296
13.000	21.935	141.567	18.446	9.636	23.322
14.750	22.467	353.695	12.567	17.171	27.2 2
20.500	22.884	521.681	14.523	13.5[illegible]	31.[illegible]
22.750	22.[illegible]	629.292	15.[illegible]	13.[illegible]	33.292
25.[illegible]	23.[illegible]	727.[illegible]	16.[illegible]	12.[illegible]	35.515

STATION [illegible] LOCATED [illegible] FT FROM FP

Z	Y	AREA	ACS	TCS	-I-I-
[illegible]	13.553	[illegible]	[illegible]	4.777	13.553
18.500	17.642	78.017	9.[illegible]	7.[illegible]	16.751
13.000	20.223	173.[illegible]	18.[illegible]	[illegible]	21.[illegible]
14.750	21.[illegible]	331.335	12.673	9.913	25.[illegible]
20.500	22.542	497.[illegible]	14.445	10.1[illegible]	29.432
22.750	22.853	598.[illegible]	15.[illegible]	13.31[illegible]	32.1[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ELAPSED TIME-MINUTES = [illegible]
ELAPSED TIME-MINUTES = [illegible]

SAMPLE OUTPUT - DAMAGE(DOC)

SAMPLE OUTPUT- DAMAGE (SOP)

[illegible]

COMP. NO.	[illegible]	[illegible]	[illegible]	[illegible]
1511	[illegible]	-12.3[illegible]	[illegible]	[illegible]
1512	[illegible]	-12.[illegible]	[illegible]	-[illegible]
1521	[illegible]	-[illegible]	[illegible]	[illegible]
1522	[illegible]	-[illegible]	[illegible]	[illegible]
FLOODED VOLUME	[illegible]	-[illegible]	[illegible]	[illegible]
INTACT SHIP	[illegible]	[illegible]	[illegible]	[illegible]
FLOODED SHIP	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] SHIP IN TONS= [illegible]

[illegible] IN FEET= [illegible]

$\frac{1.6}{36}$ ← Correction for KG. [illegible] output is a fact used [illegible]

07/31/67

```
      PROGRAM YG MULI                                                    YG   200
C     EXECUTIVE ROUTINE                                                  YG   300
      DIMENSION CHNGML(30)                                               YG   400
      DIMENSIONAIWP3(20),AREAIS(60,20),AREAPS(60),AREA6S(20,30),RML(20),DI   500
     1RMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   600
     1OWL(20),M(60),MICOMP(20),MIMOO(60),MIMAR(60),MIOUT(20),MISAO(60),MDI   700
     1ECOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),NP(8),NAME(8),NDI   800
     1AMEIS(8),NCOMP(2,3,3),NP(60),PERM(10),PERM(1)                     DI   900
      DIMENSIONPERMP(10),RAD(5,5,10),B(60,20),SPS(60),SSSHIP(20),STATNO(DI  1000
     160),SECTIM(20),TCR(C(20),TCSS(5,5,10),TCOIS(60,20),TCORS(60),THETDDI  1100
     1M(10),TPI(20),TRIMJ(6),VCRIC(20),VCRS(5,5,10),VCOIS(60,20),VCORS(6DI  1200
     10),VOL3(20),VOLS(6),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAMS(10DI  1300
     1),XIDAMS(20),XPDAMS(20),XIWI(20),XPDAM(30),XPDAMS(10)             DI  1400
      DIMENSIONXPS(20),XXM3(20),XXML(20),XXMT(20),XLIDAM(30,3),XLCRIC(20DI  1500
     1),XLCR3(20),XLCP3(20),XLCOIW(20),XLCOS(5),XMTI(20),Y(60,20),YI(60)DI  1600
     1,Z(60,20) ,YIINT(6,30),THETJM(6)                                  DI  1700
      DIMENSION XLVM(20)                                                 DI  1800
      COMMON/1/AIMA,AIWP,AIWP3,AREAIS,AREAPS,AREA6S,RML,RMT,CIA,CIALPH,CDI  1900
     1IB,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,OWL,M,MIRADC,MICOMPDI  2000
     1,MBCOMP,MIMOO,MIMAR,MIOUT,MISAO,MPMAR,M3MAR,MAMAR,MWI,IIAFT,IIBAL,DI  2100
     1IIFWD,IISYM,IIWC,IIWM,IIWL,IPWC,IPWM,IPWL,IBREAK,ICOMP,ICHKKV,INITDI  2200
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  2300
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIRUTT,NINSPL,NIMERL,NILCSDI  2400
     1,NIPERM,NITRIM,NAME,NAMEIS,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2500
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAD,S,SISHIP,SPS,SSSHIDI  2600
     1P,SPAGE,STATNO,SECTIM,TCR,TCRIC,TCRS,TCOIS,TCORS,THETIM,THETII,THEDI  2700
     1TAT,THETSM,TPI,TRIMJ,VCRIC,VCRS,VCOIS,VCORS,VOL                   DI  2800
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCFN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2900
     1WLIINC,X,XIDAM,XIDAMS,XILIM,XIM,XIW,XPDAM,XPDAMS,XPLIM,XPS,XJLIM,XDI  3000
     1ALIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCR,XLCRIC,XLCR3,XLDI  3100
     1CP,XLCP3,XLCO,XLCOIW,XLCOS,XLMRIM,XLMRDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  3200
     1,YI,YIMA,Z,WAVLOC ,XIDAMS,XPDAMS,XLMRPR,IGRAL                     DI  3300
      COMMON/4/ICAT,YIINT,N3HEEL,THETJM,LIMIT                            DI  3400
      DATA (ASTRIK= AH   * ),(DWL) = 6H   DWL),(BLANK = AH       )       YG  3500
      THETJM=0.0                                                         YG  3600
      TIME1 = TIMEF(DUMMY)/60000.                                        YG  3700
      IEOF = 999999                                                      YG  3800
      READ(5,807)ISERNO,(NAMEIS(I),I=1,8),(DATE(I),I=1,2),ITEST1,INIT,   YG  3900
     1IISYM,ICAT                                                         YG  4000
  807 FORMAT(I4,10A6,4I3)                                                YG  4100
      IF(INIT)1817,2100,1817                                             YG  4200
 2100 READ (30)ISERNO,(NAME(I),I=1,8),NSTAT,(NP(ISTAT),ISTAT=1,60    ),XLYG  4300
     1BP,XMID,JDUMMY,LIMIT,KDUMMY                                        YG  4400
      IF(ISERNO-999999)1320,1300,1320                                    YG  4500
 1300 DO 1141 ISTAT = 1, LIMIT                                           YG  4600
      NPOINT = NP(ISTAT)                                                 YG  4700
 1141 READ (30)STATNO(ISTAT), X(ISTAT),(Y(ISTAT,IPOINT),Z(ISTAT,IPOINT),YG  4800
     1AREAIS(ISTAT,IPOINT),VCOIS(ISTAT,IPOINT),TCOIS(ISTAT,IPOINT),S(ISTYG  4900
     2AT,IPOINT), IPOINT =1,NPOINT),(JBREAK(ISTAT,IBREAK), IBREAK = 1,10YG  5000
     3)                                                                  YG  5100
      WRITE (60)ISERNO,(NAME(I),I=1,8),NSTAT,(NP(ISTAT),ISTAT=1,60    ),XYG  5200
     1LBP,XMID,JDUMMY,LIMIT,KDUMMY                                       YG  5300
      DO 8462 ISTAT = 1,LIMIT                                            YG  5400
      NPOINT = NP(ISTAT)                                                 YG  5500
 8462 WRITE (60)STATNO(ISTAT), X(ISTAT),(Y(ISTAT,IPOINT),Z(ISTAT,IPOINT)YG  5600
     1,AREAIS(ISTAT,IPOINT),VCOIS(ISTAT,IPOINT),TCOIS(ISTAT,IPOINT),S(ISYG  5700
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     2TAT,IPOINT),IPOINT =1,NPOINT),(JBREAK(ISTAT,IBREAK), IBREAK = 1,10YO   5700
     3 )                                                                    YO   5800
      GO TO 8300                                                            YO   5900
 1300 WRITE (60)IEOF ,(NAME(I),I=1,8),NSTAT,(NP(ISTAT),ISTAT=1,60    ),XLYO   6000
     1BP,AMID,ICAT,LIMIT,IISYM                                              YO   6100
      REWIND 30                                                             YO   6200
      REWIND 60                                                             YO   6300
 1317 ISTOP = 0                                                             YO   6400
      READ (5,1)(KP(I), I = 1,8),AA                                         YO   6500
      CALL OFFSET                                                           YO   6600
      IF(KP(1))999,900,197                                                  YO   6700
  197 IF(ITEST1-567)196,998,198                                             YO   6800
  196 IF(ISTOP-1)199,A0,199                                                 YO   6900
C     FIND THE LOCATION OF THE FWD AND AFT PERPENDICULARS                   YO   7000
C     X(I,FWD)=X(FWD PERP)                                                  YO   7100
C     X(I,AFT)=X(AFT PERP)                                                  YO   7200
  199 DO 804 II = 1, NSTAT                                                  YO   7300
      IF(ABS(X(I,1))-A,3) 801,801,802                                       YO   7400
  801 IIFWD=II                                                              YO   7500
      GO TO 804                                                             YO   7600
  802 IF(ABS(X(I,1)-X(1,NP)-0.3) 803,803,804                                YO   7700
  803 IIAFT=II                                                              YO   7800
  804 CONTINUE                                                              YO   7900
   80 READ (5,3)XLCG,VOLID,MIRASC,TRIM                                      YO   8000
      IF(ISTOP-1)     600)1200,600)                                         YO   8100
 6001 WRITE (6,806)(NAME(I), I = 1,8), ISRANO,(DATE(I), I = 1,2)            YO   8200
      KW =1                                                                 YO   8300
      KVOL = 1                                                              YO   8400
      IF(VOLID-0000000.0)     81,82,82                                      YO   8500
   81 IF(VOLID)980,980,83                                                   YO   8600
   82 THETIT = ATAN(TRIM/XLBP)                                              YO   8700
      CALL VOLUME                                                           YO   8800
      XLCG = XLCR                                                           YO   8900
      VOLID=VOL                                                             YO   9000
      GO TO 88                                                              YO   9100
   83 IF(MIRASC-8000000.0)     980,980,831                                  YO   9200
  831 VOLID = VOLID*95.0                                                    YO   9300
      IF(XLCG-800000.0)     830,84,84                                       YO   9400
  830 IIBAL=1                                                               YO   9500
      CALL BAL                                                              YO   9600
      TRIM=XLBP*(SIN(THETIT)/COS(THETIT))                                   YO   9700
      GO TO 88                                                              YO   9800
  981 FORMAT(/35H DATA SUBMISSION ERROR ON VOLID,XLCG,MIRASC,TRIM CARD= SYO   9900
     1EE INPUT INSTRUCTIONS = CANNOT PROCEED.)                              YO  10000
  980 WRITE (6,981)                                                         YO  10100
      ISTOP = 1                                                             YO  10200
      GO TO 1200                                                            YO  10300
   84 THETIT = ATAN(TRIM/XLBP)                                              YO  10400
      IIBAL = 3                                                             YO  10500
      CALL BAL                                                              YO  10600
      XLCG = XLCR                                                           YO  10700
   85 VOL1 = VOLID/35.0                                                     YO  10800
      WRITE (6,86)VOL1, XLCG                                                YO  10900
   86 FORMAT(/21H3DESIGN DISPLACEMENT=F10.3,3H TONS/                        YO  11000
     1                                 12H DESIGN LCG= F10.3, 2X,           YO  11100
     2 28HFT FROM AMIDSHIPS (+ FWD) )                                       YO  11200
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```
      WRITE (6,88)HIBASC                                                    V6 11300
   88 FORMAT(14H DESIGN DRAFT= F10.3,3H FT)                                 V6 11400
      WRITE (6,87)TH,M                                                      V6 11500
   87 FORMAT(13H DESIGN TRIM= F10.3,29H (+ IS BY BOW, - IS BY STERN))       V6 11600
      XLOA = X(NSTAT)-X(1)                                                  V6 11700
      WRITE (6,1362)XLBP,XLOA                                               V6 11800
 1362 FORMAT( 33H LENGTH BETWEEN PERPINDICULARS =F8.2, 4H FT,/ 18H LENGTV6 11900
     1H OVERALL = F8.2, 4H FT.)                                             V6 12000
      IF(ICAT-2)728,1289,1289                                               V6 12100
  728 KW=1                                                                  V6 12200
      CALL DRAFT                                                            V6 12300
      DO 600  ISTA=1,NSTAT                                                  V6 12400
      CALL AREAS                                                            V6 12500
  600 CONTINUE                                                              V6 12600
      MA=1                                                                  V6 12700
      DO 601    ISTA=2,NSTAT                                                V6 12800
      IF(AREABS(MA)-AREABS(ISTA))    602,601,601                            V6 12900
  602 MA=ISTA                                                               V6 13000
  601 CONTINUE                                                              V6 13100
      ISTA=MA                                                               V6 13200
      AIMA=AREABS(MA)                                                       V6 13300
      WRITE (6,603)X(MA)                                                    V6 13400
  603 FORMAT(40H STATION OF MAX AREA (AT DWL) IS LOCATED,                   V6 13500
     1                                                F10.3,17H FT FROM FWD PEV6 13600
     2RP)                                                                   V6 13700
      CALL WPLAN(1)                                                         V6 13800
      YIMA=Y(1,ISTA)                                                        V6 13900
      BEAM = YIMA*2.0                                                       V6 14000
      WRITE (6,604)BEAM                                                     V6 14100
      CK = AIMA/(BEAM*(W(MA)+(ABS(Z(MA,1))-Z(MA,1))/2.0))                   V6 14200
      WRITE (6,1374)CK                                                      V6 14300
 1374 FORMAT(33H SECTION AREA COEFFICIENT AT STATION OF MAXIMUM AREA=       V6 14400
     1F8.3)                                                                 V6 14500
  604 FORMAT(20H BEAM AT STA OF MAX AREA=,F10.3,3H FT)                      V6 14600
 1289 IPROG = 1                                                             V6 14700
   40 ITEST3 = KP(IPROG)                                                    V6 14800
      IF(ITEST3) 999,130,42                                                 V6 14900
   42 GO TO (20,70,90,3000,3999,1142,60,99),ITEST3                          V6 15000
   20 READ(5,1) NWL,NITRIM,N3WHEEL                                          V6 15100
      READ (5,2222)(WLOUT(I), I = 1,NWL)                                    V6 15200
      IF(NITRIM)2223,727,2223                                               V6 15300
 2223 READ (5,2222)(TRIM3(I),I=1,NITRIM)                                    V6 15400
 2222 FORMAT(F10.3)                                                         V6 15500
  727 IF(N3WHEEL)729,2224,729                                               V6 15600
  729 READ(5,2222) (THET3W(I),I=1,N3WHEEL)                                  V6 15700
 2224 WRITE (6,806)(NAME(I), I=1,8), IBPRNO, (DATE(I), I = 1,2)             V6 15800
      DO 905 I = 1,24                                                       V6 15900
  905 DWL(I) = BLANK                                                        V6 16000
      DO 1900 I = 1,NWL                                                     V6 16100
      IF(ABS(WLOUT(I)-HIBASC)-0.001) 902,902,8994                           V6 16200
 8994 IF(WLOUT(I)-HIBASC)1900,902,903                                       V6 16300
 1900 CONTINUE                                                              V6 16400
      GO TO 909                                                             V6 16500
  903 NINWL = NWL-I+1                                                       V6 16600
      NWL = NWL + 1                                                         V6 16700
      DO 904 I = 1,NINWL                                                    V6 16800
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      N2NWL = NWL-1+1                                                   YG 16900
  904 HIOUT(N2NWL) = HIOUT(N2NWL-1)                                     YG 17000
      HIOUT(N2NWL-1) = HIBASC                                           YG 17100
      DWL(N2NWL-1) = DWL1                                               YG 17200
      GO TO 908                                                         YG 17300
  909 WRITE (6,910)                                                     YG 17400
  910 FORMAT( 41H DESIGN WATERLINE GREATER THAN ANY OUTPUT WATERLINE SUBYG 17500
     1MITTED)                                                           YG 17600
      NWL = NWL + 1                                                     YG 17700
      HIOUT(NWL) = HIBASC                                               YG 17800
      DWL(NWL) = DWL1                                                   YG 17900
      GO TO 908                                                         YG 18000
  907 DWL(1) = DWL1                                                     YG 18100
  908 WRITE (6,801)NWL, (HIOUT(I),DWL(I), I = 1,NWL)                    YG 18200
  801 FORMAT(20H NUMBER OF OUTPUT WATERLINES= I3,// 20H HEIGHT OF OUTPUTYG 18300
     1 WATERLINES / 23H ABOVE BASELINE IN FEET/(F10.2,A6))              YG 18400
      WRITE (6,1400)                                                    YG 18500
 1400 FORMAT(/ 34H DESIGN WATERLINE INDICATED BY DWL)                   YG 18600
      IF(NITRIM)2225,730,2225                                           YG 18700
 2225 WRITE (6,2227)NITRIM, (TRIMS(I), I = 1,NITRIM)                    YG 18800
 2227 FORMAT(///24H NUMBER OF OUTPUT TRIMS=I3/14H TRIMS IN FEET/(F10.2))YG 18900
  730 IF(NSHEEL)731,40,731                                              YG 19000
  731 WRITE(6,2228) NSHEEL, (THETSH(I),I=1,NSHEEL)                      YG 19100
 2228 FORMAT(///24H NUMBER OF OUTPUT HEELS=I3/20H HEEL ANGLES IN DEGREESYG 19200
     1/(F10.5))                                                         YG 19300
   40 IPROB = IPROB + 1                                                 YG 19400
      GO TO 50                                                          YG 19500
   70 CALL DERIVE                                                       YG 19600
      GO TO 60                                                          YG 19700
   50 READ (5,400)NSTATS,HW1,WAVCEN,XLMBIR ,IIWM,WMIINC,IIWL,WLIINC, IIWYG 19800
     1C,WCIINC                                                          YG 19900
      IF(IIWM)  3001,3000,3001                                          YG 20000
 3000 IIWM=1                                                            YG 20100
 3001 IF(IIWL)    3003,3002,3003                                       YG 20200
 3002 IIWL=1                                                            YG 20300
 3003 IF(IIWC)   3005,3004,3005                                         YG 20400
 3004 IIWC=1                                                            YG 20500
 3005 READ (5,401)(XIW(J),WEIGHT(J),XLCGIW(J),SECTIM(J),J=1,NSTATS)     YG 20600
      WRITE (6,806)(NAME(I), I = 1,8), ISERNO,(DATE(I), I = 1,8)        YG 20700
      WRITE (6,804)NSTATS, WAVCEN, XLMBIR                               YG 20800
  804 FORMAT(21H NUMBER OF WEIGHT STATIONS= I5/19H WAVE CENTERF9.2,2X,   YG 20900
     1 28HFT FROM AMIDSHIPS (+ FWD)                                     YG 21000
     2                        /18H WAVE LENGTH/LBP = F8.3)              YG 21100
      ITEST1 = HW1 + 1.0                                                YG 21200
      GO TO (905,50A,990),ITEST1                                        YG 21300
  990 WRITE (6,806)(NAME(I), I = 1,8), ISERNO, (DATE(I), I = 1,8)       YG 21400
      WRITE (6,992)                                                     YG 21500
  992 FORMAT(54H DATA SUBMISSION ERROR OF HW1= SEE INPUT INSTRUCTIONS= /YG 21600
     1 71H WILL EXECUTE LONGITUDINAL STRENGTH WITH WAVE LENGTH = 1.1*SQRYG 21700
     2 ROOT LBP)                                                        YG 21800
      HW1 = 0.0                                                         YG 21900
  905 WRITE (6,907)                                                     YG 22000
  907 FORMAT(31H WAVE HEIGHT=1.1 * SQR. ROOT LBP)                       YG 22100
      GO TO 920                                                         YG 22200
  906 WRITE (6,908)                                                     YG 22300
  908 FORMAT(10H WAVE HEIGHT=LBP/20)                                    YG 22400
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      WRITE (6,1021)                                                    V6 22800
 1021 FORMAT(//19H WEIGHT STATION 9X6HWEIGHT8X14HLCG OF WEIGHT          V6 22900
     1,10X,10HSECT MODUL /                                              V6 23000
     214H   (FT FROM PP),6X,6H(TONS),4X   ,18HFROM AMIDSHIPS   /        V6 23100
     3 38X,11H(FT, + FWD)//)                                            V6 23200
      DO 1022     J=1,NSTATA                                            V6 23300
      IF(ABS(SECTIM(J))-0.0001) 1023,1023,1022                          V6 23400
 1022 WRITE (6,82)X(W(J),WEIGHT(J),XLCG(W(J),SECTIM(J)                  V6 23500
   82 FORMAT                    (F14.2,2XF10.2,3X,F10.2,10X,F10.2)      V6 23600
      GO TO 1021                                                        V6 23700
 1023 WRITE (6,82)X(W(J),WEIGHT(J),XLCG(W(J)                            V6 23800
 1021 CONTINUE                                                          V6 23900
      GO TO 60                                                          V6 24000
 3999 IF(ITEST3-4)     999,4000,4010                                    V6 24100
 4000 ITEST1=10                                                         V6 24200
      IPROG=IPROG+1                                                     V6 24300
      IF(NP(IPROG)-5)          100,4020,100                             V6 24400
 4020 ITEST1=10                                                         V6 24500
      IPROG=IPROG+1                                                     V6 24600
      GO TO 100                                                         V6 24700
 4010 ITEST1=20                                                         V6 24800
      IPROG=IPROG+1                                                     V6 24900
C     ITEST1=10,FLNGTH ONLY,=15,FLNGTH AND MILIM,=20,MILIM ONLY         V6 25000
  100 WRITE (6,800)(NAME(I), I=1,8), IBERNO, (DATE(I), I = 1,3)         V6 25100
      JSTAT = NSTAT+1                                                   V6 25200
      LL = 1                                                            V6 25300
      DO 1348 I = 1,20                                                  V6 25400
 1348 CHNGML(I) = BLANK                                                 V6 25500
      DO 101 J = 1,JSTAT                                                V6 25600
      READ (5,104)STAT, HGMAR                                           V6 25700
  104 FORMAT(F7.3,F10.2)                                                V6 25800
      IF(STAT-9999.0)     102,1030,1030                                 V6 25900
  102 DO 105 L = 1,NSTAT                                                V6 26000
      IF(STATNO(L) - STAT) 105,107,105                                  V6 26100
  107 MIMAR(L) = HGMAR                                                  V6 26200
      CHNGML(L) = ASTRIK                                                V6 26300
      GO TO 101                                                         V6 26400
  105 CONTINUE                                                          V6 26500
  106 WRITE (6,703)STAT,HGMAR                                           V6 26600
  101 CONTINUE                                                          V6 26700
 1030 WRITE (6,883)(STATNO(J),X(J),MIMAR(J),CHNGML(J), J=1,NSTAT)       V6 26800
  883 FORMAT(1H0 MARGIN LINE//11H MARGIN LINE ASSUMED 3 INCHES BELOW UPPV6 26900
     1ERMOST Z OF STATION EXCEPT WHERE INDICATED BY *, IN WHICH CASE THAV6 27000
     2T HEIGHT/23H WAS SUBMITTED AS INPUT//                             V6 27100
     38H STATION3X16HDISTANCE FROM PP3X15HHEIGHT ABOVE BL/              V6 27200
     4)3X8HIN  FEET)3X8HIN  FEET/(F7.3,3XF10.2,3XF10.2,A6))             V6 27300
  703 FORMAT(31H0MARGIN LINE CHANGE AT STATION F8.3, 48H CANNOT BE MADE V6 27400
     1- THERE IS NO SUCH INPUT STATION)                                 V6 27500
  884 FORMAT(////26H NUMBER OF PERMEABILITIES  13//19H PERMEABILITIES/(FV6 27600
     110.3))                                                            V6 27700
  701 IF(ITEST-15)     103,103,120                                       V6 27800
  103 READ (5,8)NIPERM, (PERM1(J), J = 1,NIPERM)                        V6 27900
      WRITE (6,884)NIPERM,( PERM1(J), J=1,NIPERM)                       V6 28000
      IF (ITEST1-15)     40,120,999                                     V6 28100
  120 DO 2012   I=1,10                                                  V6 28200
 2012 PERMR(I)=999.0                                                    V6 28300
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      DO 2001  I=1,2                                                    YG 28100
      DO 2001   J=1,3                                                   YG 28200
      JMAX(I)=0                                                         YG 28300
 2001 KMAX(I,J)=0                                                       YG 28400
      READ (5,1000)(((NCOMPB(I,J,K),K=1,3),J=1,9),I=1,2)                YG 28500
 1000 FORMAT(3(3I3,3X))                                                 YG 28600
 1004 READ (5,1001)NAMEIC,X1DAM3,X2DAM3,PERM3                           YG 28700
 1001 FORMAT(I3,2X,3F10.3)                                              YG 28800
      IF(NAMEIC-999)    1002,1000,1002                                  YG 28900
 1002 X1DAMB(NAMEIC)=X1DAM3                                             YG 29000
      X2DAMB(NAMEIC)=X2DAM3                                             YG 29100
      PERMB(NAMEIC)=PERM3                                               YG 29200
      GO TO 1004                                                        YG 29300
 1000 WRITE (6,1050)                                                    YG 29400
 1050 FORMAT(1H1,9X,45HFOR LIMITING DRAFT CALCULATIONS THE FOLLOWING/1HYG 29500
     1,13X,38HCOMPARTMENT GROUPS HAVE BEEN SUBMITTED //)                YG 29600
      DO 1006    I=1,2                                                  YG 29700
 1006 DO 1006    J=1,3                                                  YG 29800
      IF(NCOMPB(I,J,1))    1010,1006,1010                               YG 29900
 1010 JMAX(I)=JMAX(I)+1                                                 YG 30000
      GO TO (1051,1052),  I                                             YG 30100
 1051 WRITE (6,1054)J                                                   YG 30200
 1054 FORMAT(/ 16H FORWARD GROUP  ,I3,44H CONTAINING THE FOLLOWING COMPAYG 30300
     1RTMENTS    )                                                      YG 30400
      GO TO 2007                                                        YG 30500
 1052 WRITE (6,1055)J                                                   YG 30600
 1055 FORMAT(/13H AFTER GROUP  ,I3, 44H CONTAINING THE FOLLOWING COMPARTYG 30700
     1MENTS    )                                                       YG 30800
 2007 DO 1099  K=1,3                                                    YG 30900
      IF(NCOMPB(I,J,K))    1007,1006,1007                               YG 31000
 1007 KMAX(I,J)=KMAX(I,J)+1                                             YG 31100
      WRITE (6,1070)NCOMPB(I,J,K)                                       YG 31200
 1070 FORMAT(I5)                                                        YG 31300
 1099 CONTINUE                                                          YG 31400
 1006 CONTINUE                                                          YG 31500
      WRITE (6,2004)                                                    YG 31600
 2004 FORMAT(/40H COMPARTMENT DESCRIPTIONS   //)                        YG 31700
      WRITE (6,2002)                                                    YG 31800
 2002 FORMAT(4X,                                                        YG 31900
     1       12H COMPARTMENT 3X,12H  FOREWARD   12H    AFTER    ,13HPERMYG 32000
     2EABILITY/  9X                                                     YG 32100
     3 ,       12H   NUMBER   3X,10H LIMIT (FT       3X,10H LIMIT (FT ) YG 32200
     4/#1X,8HFROM FP),4X , 8HFROM FP)          /)                      YG 32300
      DO 2011   M=1,78                                                  YG 32400
      IF(ABS(PERMB(M)-999.0)-0.0001) 2011,2011,2013                     YG 32500
 2013 WRITE (6,2000)M ,X1DAMB(M),X2DAMB(M),PERMB(M)                     YG 32600
 2000 FORMAT(I12,3X,3F12.3)                                             YG 32700
 2011 CONTINUE                                                          YG 32800
      GO TO 40                                                          YG 32900
 1142 KVOL = 1                                                          YG 33000
      KW = 1                                                            YG 33100
      READ(5,14) NIDBPL,IIDBPL,VOLB                                     YG 33200
      READ(5,14)NILCG,IILCG,XLCGB                                       YG 33300
      READ(5,10  ) NWHEEL,THEISH                                        YG 33400
   14 FORMAT(I3,I2,6F10.6)                                              YG 33500
   10 FORMAT(I3,2X,1AF7.2)                                              YG 33600
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      IF(I1DSPL)810,810,811                                                  V6 33700
  811 THETIT = 0.                                                            V6 33800
      DO 812 L=1,N1DSPL                                                      V6 33900
      M1BASC=VOL0(L)                                                         V6 34000
      CALL VOLUME                                                            V6 34100
  812 VOL0(L) = VOL                                                          V6 34200
  810 IF(I1LCG)813,813,814                                                   V6 34300
  814 I1RAL = 3                                                              V6 34400
      DO 815 L=1,N1LCG                                                       V6 34500
      THETIT = ATAN(XLCGB(L)/ALAP)                                           V6 34600
      CALL BAL                                                               V6 34700
  815 XLCGB(L)=XLCG                                                          V6 34800
  813 WRITE (6,11)N1DSPL,(VOL0(I),I=1,N1DSPL)                                V6 34900
   10 FORMAT(3X,16HINPUT NR OF  LCG,I6,16HINPUT  LCG,8X,8(F10.3,3X))         V6 35000
   11 FORMAT(3X,16HINPUT NR OF DSPL,I6,16HINPUT nSPL,8X,8(F10.3,3X))         V6 35100
      WRITE (6,12)N1LCG,(XLCGB(I),I=1,N1LCG)                                 V6 35200
      WRITE (6,13)N1WEEL,(THETSW(I),I=1,N1WEEL)                              V6 35300
   13 FORMAT(3X,16HINPUT NR OF WEEL,I6,16HINPUT WEEL,8X,8(F10.3,3X))         V6 35400
      IPROG=IPROG+1                                                          V6 35500
      GO TO 40                                                               V6 35600
   99 CALL CMPRTMNT                                                          V6 35610
      GO TO 40                                                               V6 35620
  100 IPROG = 1                                                              V6 35700
      KP(11STOP) = 0                                                         V6 35800
  140 ITEST1 = KP(IPROG)                                                     V6 35900
      TIME = TIMEF(DUMMY)/60000.-TIME1                                       V6 36000
      TIME1 = TIMEF(DUMMY)/60000.                                            V6 36100
      WRITE(6,888) TIME                                                      V6 36200
  888 FORMAT(' ELAPSED TIME=MINUTES =' F10.1)                                V6 36300
      IF(ITEST1) 999,900,300                                                 V6 36400
  300 GO TO(330,350,360,370,380,390,900),ITPST1                              V6 36500
  330 CALL HYDRO                                                             V6 36600
      GO TO 900                                                              V6 36700
  350 CALL STRNTH                                                            V6 37000
      GO TO 900                                                              V6 37010
  360 CALL FLNDTH                                                            V6 37300
      GO TO 900                                                              V6 37400
  370 CALL HILIM                                                             V6 37500
  900 IPROG = IPROG + 1                                                      V6 37600
      GO TO 140                                                              V6 37700
  380 CALL INTACT                                                            V6 37800
      IPROG = IPROG + 1                                                      V6 37900
      GO TO 140                                                              V6 38000
  390 CALL DAMAGE                                                            V6 38100
      IPROG = IPROG + 1                                                      V6 38200
      GO TO 140                                                              V6 38300
  900 READ(5,807)ISERNO,(NAME1S(I),I=1,8),(DATE(I),I=1,2),ITEST1,INIT,      V6 38400
     1I1SYM,ICAT                                                             V6 38500
      IF(ISERNO-9999)1817,998,999                                            V6 38600
  998 REWIND 30                                                              V6 38700
  999 STOP                                                                   V6 38800
    1 FORMAT(9I3)                                                            V6 38900
    3 FORMAT(8F10.3)                                                         V6 39000
  400 FORMAT(I5,3F5.4,3(I5,F5.2))                                            V6 39100
  401 FORMAT(4F10.3)                                                         V6 39200
  411 FORMAT(F10.3)                                                          V6 39300
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480 FORMAT(I5)                                                          YG 39400
    8 FORMAT(I3,/(F10.2))                                               YG 39500
866 FORMAT(6H1SHIP-6A8,5X16HSERIAL NUMBER-I4,5X8HDATE-8A4/)             YG 39600
    END                                                                 YG 39700
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      SUBROUTINE AREAS                                                  AR   0200
      DIMENSION  YSS(20), YSS(6), ZSS(4), AREASS(6), VCOSS(6),TCOSS(6)AR   0300
      DIMENSIONAIWPJ(20),AREAIS(60,20),ARPAPS(60),AREAAS(20,30),RML(20),DI  0400
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL3(20),DI  0500
     1DWL(20),M(60),MICOMP(20),MIMOO(60),MIMAM(60),MIUUT(20),MIBAS(60),MDI  0600
     1BCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI  0700
     1AMEIS(8),NCOMPP(2,3,3),NP(60),PERM(1M),PERM1(3)                   DI  0800
      DIMENSIONPERM2(1M),HAB(5,5,10),S(60,20),SSS(60),SSRHIP(20),STATNO(DI  0900
     160),SECTIM(25),TCSIC(25),TCSS(5,5,10),TCSIS(60,20),TCSSS(60),THETSDI  1000
     1M(10),TPI(20),TRIM3(6),VCSIC(25),VCSS(5,5,10),VCSIS(60,20),VCSSS(6DI  1100
     10),VOL3(20),VOLS(5),VOLIC(25),WEIGHT(25),X(60),XIDAM(30),XIDAM2(10DI  1200
     1),XIDAM3(20),XPDAM(20),XIW(25),XPDAM(30),XBDAM2(10)               DI  1300
      DIMENSIONXP(8),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCMIC(25)DI  1400
     1),XLCS3(20),XLCP3(20),XLCSIW(25),XLCSS(5),XMTI(20),Y(60,20),YI(60)DI  1500
     1,Z(60,20),YIINT(6,30),THETSM(5)                                   DI  1600
      DIMENSION XLVM(25)                                                DI  1700
      COMMON/1/AIMA,AIWP,AIWPJ,AREAIS,AREASS,ARPAAS,BML,BMT,CIA,CIALPH,CDI  1800
     1IS,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,M,MIBASC,MICOMPDI  1900
     1,MICOMP,MIMOO,MIMAM,MIUUT,MIBAS,MSMAR,MSMAR,MSMAR,MWI,IIAFT,IIBAL,DI  2000
     1IIFWD,IIBYM,IIWC,IIWM,IIWL,IBWC,IBWM,IBWL,IBREAK,ICOMP,ICMERK,INITDI  2100
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI  2200
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIOBPL,NIMEEL,NILCODI  2300
     1,NIPERM,NITRIM,NAME,NAMEIS,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2400
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SSRHIP,SSS,SSRHIDI  2500
     1P,SPACE,STATNO,SECTIM,TCU,TCSIC,TCSS,TCSIS,TCSSS,THETIM,THETIT,THEDI  2600
     1TAT,THETSM,TPI,TRIM3,VCSIC,VCSS,VCSIS,VCSSS,VOL                   DI  2700
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCEN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2800
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPS,XSLIM,XDI  2900
     1SLIM,XIIL,XIIT,XKM,XKM3,XKML,XKMT,XLIDAM,XLSP,XLCS,XLCSIC,XLCS3,XLDI  3000
     1CP,XLCP3,XLCU,XLCSIW,XLCSS,XLMBIM,XLMBDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  3100
     1,YI,YIMA,Z,WAVLOC ,XIDAM3,XPDAM3,XLMBDR,IGBAL                     DI  3200
      COMMON/4/ICAT,YIINT,NSHEEL,THETSM,LIMIT                           DI  3300
C     START LOGIC                                                       AM  3400
      TRANS(Q0000FL,Q0001FL,Q0002FL,Q0003FL)=Q0000FL*COS(Q0002FL)*Q0001FL*SIN(QAR  3500
     1Q0002FL)+Q0003FL                                                  AR  3600
      TEST(QU004FL,Q0005FL,Q0006FL,Q0007FL,Q0008FL,Q0009FL) =((Q0004FL-Q0005FL)/AR  3700
     1(SIN(Q0006FL)/COS(Q0006FL))+Q0007FL*Q0008FL)+Q0009FL               AR  3800
      MS=M                                                              AR  3900
      IS = ISTAT                                                        AR  4000
  888 M=NP(ISTAT)                                                       AR  4100
      NIINT=1                                                           AR  4200
      AREASS=0.0                                                        AR  4300
      TCSSS=0.0                                                         AR  4400
      VCSSS=0.0                                                         AR  4500
      IF(ABS(THETIM)-0.0001) 116,116,117                                AR  4600
  116 IITEST=1                                                          AR  4700
      XSS(1)=X(ISTAT)                                                   AR  4800
      ISTART=1                                                          AR  4900
      LSTOP=1                                                           AR  5000
      GO TO 3103                                                        AR  5100
  117 IITEST=2                                                          AR  5200
      THETSM=THETIM                                                     AR  5300
      THETIM=ABS(THETIM)                                                AR  5400
      TANZ =SIN(THETIM)/COS(THETIM)                                     AR  5500
      CALL TEST1(M,ISTAT,Z)                                             AR  5600
      XT=X                                                              AR  5700
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C   K=1,STBD INTERSECTIONS ONLY                                                    AR  5700
C   K=2,3,PORT AND STBD INTERSECTIONS                                              AR  5800
C   K=4,PORT INTERSECTIONS ONLY                                                    AR  5900
      GO TO (7100,3100,3100,3104),KT                                               AR  6000
 7100 NWP=NP(ISTAT)-1                                                              AR  6100
 3100 IF(I.LSYM)     3110,3104,3104                                                AR  6200
 3104 SINE1=1.0                                                                    AR  6300
      SINE2=1.0                                                                    AR  6400
      ISTART=1                                                                     AR  6500
      LSTOP=NWP-1                                                                  AR  6600
      IF(LSTOP-M)         8103,8103,7100                                           AR  6700
 8103 SLOPE2=TAN2                                                                  AR  6800
      GO TO 3103                                                                   AR  6900
 3110 GO TO (6100,3106,3106,3106),KT                                               AR  7000
 6100 IF(I.LSYM)6150,6150,3120                                                     AR  7100
 3106 IF(I.LSYM)      3107,3107,3120                                               AR  7200
 3107 SINE1=-1.0                                                                   AR  7300
      SINE2=1.0                                                                    AR  7400
      ISTART=NWP-1                                                                 AR  7500
      LSTOP=NP(ISTAT)                                                              AR  7600
      IF(ISTART-LSTOP) 8101,8101,6160                                              AR  7700
 8101 GO TO (6160,3101,3101,8104),KT                                               AR  7800
 3101 ZSS(1)=M(ISTAT)                                                              AR  7900
      YSS(1)=0.0                                                                   AR  8000
      YSSION(N1,INT)=1.0                                                           AR  8100
      SLOPE2=TAN2                                                                  AR  8200
      II TEST=4                                                                    AR  8300
      I START=L STOP                                                               AR  8400
      GO TO 3103                                                                   AR  8500
 8901 I START=NWP-1                                                                AR  8600
      II TEST=2                                                                    AR  8700
      SINE 2=-1.0                                                                  AR  8800
      GO TO 3103                                                                   AR  8900
 3120 AREASS(ISTAT) =0.0                                                           AR  9000
      TCOSS(ISTAT)=0.0                                                             AR  9100
      VCOSS(ISTAT)=0.0                                                             AR  9200
      SSS(ISTAT)=0.0                                                               AR  9300
      GO TO 7000                                                                   AR  9400
 8104 SINE2=-1                                                                     AR  9500
      ISTART = ISTART-1                                                            AR  9501
 3103 DO 400     I=ISTART,LSTOP                                                    AR  9600
      IF(III TEST-2)      401,6161,401                                             AR  9700
 6161 TESTF2=TEST(Z(ISTAT,I),M(ISTAT),THETIM,Y(ISTAT,I),SINE1,SINE2)               AR  9800
      IF(TESTF2)     400,120,3111                                                  AR  9900
 3111 IF(TESTF2-0.001)     120,120,110                                            AR 10000
C    IF TESTF2=0,INTERSECTION IS AT Z(ISTAT,NWP)                                  AR 10100
C    IFTESTF2 IS LESS THAN 0,NO INTERSECTION                                      AR 10200
  120 AREASS(N1,INT)=AREAS(ISTAT,I) /2.0                                           AR 10300
      VCOSS(N1,INT)=VCOS(ISTAT,I)                                                  AR 10400
      TCOSS(N1,INT)=TCOS(ISTAT,I)                                                  AR 10500
      ZSS(N1,INT)=Z(ISTAT,I)                                                       AR 10600
      YSS(N1,INT)=Y(ISTAT,I)                                                       AR 10700
      GO TO 3108                                                                   AR 10800
  110 IF(I-1)1102,1101,1102                                                        AR 10900
 1101 YSS(N1,INT)=ABS((M(ISTAT)-Z(ISTAT,1))/SLOPE2)                                AR 11000
      ZSS(N1,INT)=  Z(ISTAT,1)                                                     AR 11100
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      GO TO 401                                                          AR 11200
C                                                                        AR 11300
 110  DO 111 IBREAK=1,10                                                 AR 11400
      IF(JBREAK(ISTAT,IBREAK)-I) 111,112,111                             AR 11500
  111 CONTINUE                                                           AR 11600
      M=I+1                                                              AR 11700
      GO TO 113                                                          AR 11800
  112 DO 114 IBREAK=1,10                                                 AR 11900
      IF(JBREAK(ISTAT,IBREAK)-I+1) 114,113,114                           AR 12000
  114 CONTINUE                                                           AR 12100
      M=1                                                                AR 12200
      GO TO 113                                                          AR 12300
C     LINEAR INTERPOLATION                                               AR 12400
C                                                                        AR 12500
  113 IF(ABS (Y(ISTAT,I)-Y(ISTAT,I-1))-0.000) 8182,8182,8184             AR 12600
 8184 SLOPE1=(Z(ISTAT,I)-Z(ISTAT,I-1))/(Y(ISTAT,I)-Y(ISTAT,I-1))         AR 12700
      YSS(N,INT)=(Z(ISTAT,I-1)-M(ISTAT)-Y(ISTAT,I-1)*SLOPE1)/(SLOPE1     AR 12800
     1-SLOPE2)                                                           AR 12900
 8183 ZSS(N,INT)=SLOPE2*YSS(N,INT)+M(ISTAT)                              AR 13000
      GO TO 401                                                          AR 13100
 8182 YSS(N,INT)=Y(ISTAT,I)                                              AR 13200
      GO TO 8183                                                         AR 13300
C     PARABOLIC INTERPOLATION                                            AR 13400
C                                                                        AR 13500
  113 ZP3=TRANS(Z(ISTAT,M),Y(ISTAT,M),THET(M,SINE))                      AR 13600
      ZP2=TRANS(Z(ISTAT,M-1),Y(ISTAT,M-1),THET(M,SINE))                  AR 13700
      ZP1=TRANS(Z(ISTAT,M-2),Y(ISTAT,M-2),THET(M,SINE))                  AR 13800
      HP1=TRANS(M(ISTAT),0.0,THET(M,0.0)                                 AR 13900
      YP3=TRANS(Y(ISTAT,M),Z(ISTAT,M),THET(M,-SINE))                     AR 14000
      YP2=TRANS(Y(ISTAT,M-1),Z(ISTAT,M-1),THET(M,-SINE))                 AR 14100
      YP1=TRANS(Y(ISTAT,M-2),Z(ISTAT,M-2),THET(M,-SINE))                 AR 14200
      CALL COEF11(ZP1,ZP2,ZP3,HP1)                                       AR 14300
      YP1=C1A*YP3+C1B*YP2+C1C*YP1                                        AR 14400
      YSS(N,INT)=TRANS(YP1,HP1,THET(M,SINE))                             AR 14500
      ZSS(N,INT)=TRANS(HP1,YP1,THET(M,-SINE))                            AR 14600
C                                                                        AR 14700
C     END OF INTERSECTION SOLUTION                                       AR 14800
C       AREA SOLUTION                                                    AR 14900
 401  M=NP (ISTAT)                                                       AR 15000
      CALL TEST1(ZSS(N,INT),Z)                                           AR 15100
      GO TO (20,30,50,40),K                                              AR 15200
   20 AREAS(ISTAT)=AREAS(ISTAT,M)                                        AR 15300
      TCOS(ISTAT)=TCOS(ISTAT,M)                                          AR 15400
      VCOS(ISTAT)=VCOS(ISTAT,M)                                          AR 15500
      KK=ISTAT                                                           AR 15600
      SSS(ISTAT) = S(ISTAT,M)                                            AR 15700
      GO TO 10                                                           AR 15800
   30 AREAS(ISTAT)=AREAS(ISTAT,NWP)                                      AR 15900
      VCOS(ISTAT) = VCOS(ISTAT,NWP)                                      AR 16000
      TCOS(ISTAT) = TCOS(ISTAT,NWP)                                      AR 16100
      SSS(ISTAT) = S(ISTAT,NWP)                                          AR 16200
      GO TO 10                                                           AR 16300
   40 AREAS(ISTAT)=0.0                                                   AR 16400
      TCOS(ISTAT)=0.0                                                    AR 16500
      VCOS(ISTAT)=0.0                                                    AR 16600
      SSS(ISTAT) = 0.0                                                   AR 16700
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      GO TO 10                                                                  AR 16800
   90 DO 49 IBREAK = 1,10                                                       AR 16900
      IF(JBREAK(ISTAT,IBREAK)-NWP-1)49,70,49                                    AR 17000
   49 CONTINUE                                                                  AR 17100
   60 M = NWP                                                                   AR 17200
      GO TO 80                                                                  AR 17300
   70 IF(JBREAK(ISTAT,IBREAK-1)-NWP) 71,72,71                                   AR 17400
   72 AREA2S(ISTAT)=AREA1S(ISTAT,NWP)*                                          AR 17500
     1                          (AREA1S(ISTAT,NWP+1)-AREA1S(ISTAT              AR 17600
     2,NWP) )          *(ZSS(NIINT)                                           AR 17700
     3-Z(ISTAT,NWP))/(Z(ISTAT,NWP+1)-Z(ISTAT,NWP))                              AR 17800
      VCO2S(ISTAT)=VCO1S(ISTAT,NWP)*                                            AR 17900
     1                          (VCO1S(ISTAT,NWP+1)-VCO1S(ISTAT,NWP))          AR 18000
     2*          (ZSS(NIINT)                                                    AR 18100
     3       -Z(ISTAT,NWP))/(Z(ISTAT,NWP+1)-Z(ISTAT,NWP))                       AR 18200
      TCO2S(ISTAT)=TCO1S(ISTAT,NWP)*                                            AR 18300
     1                          (TCO1S(ISTAT,NWP+1)-TCO1S(ISTAT,NWP))          AR 18400
     2*          (ZSS(NIINT)                                                    AR 18500
     3       -Z(ISTAT,NWP))/(Z(ISTAT,NWP+1)-Z(ISTAT,NWP))                       AR 18600
      GO TO 3490                                                                AR 18700
   71 M=NWP-1                                                                   AR 18800
   80 Z1 = Z(ISTAT,M)                                                           AR 18900
      Z2 = Z(ISTAT,M+1)                                                         AR 19000
      Z3 = Z(ISTAT,M+2)                                                         AR 19100
      CALL COEFII(Z1,Z2,Z3,ZSS(NIINT))                                          AR 19200
      AREA2S(ISTAT)=FINTP2(AREA1S(ISTAT,M  +1), AREA1S(ISTAT,M  +2),            AR 19300
     1AREA1S(ISTAT,M  ))                                                        AR 19400
      IF(AREA2S(ISTAT)) 2000,3000,3000                                          AR 19500
 2000 AREA2S(ISTAT) = 0.0                                                       AR 19600
      VCO2S(ISTAT) = 0.0                                                        AR 19700
      TCO2S(ISTAT) = 0.0                                                        AR 19800
      GO TO 3490                                                                AR 19900
 3000 VCO2S(ISTAT) = FINTP2(VCO1S(ISTAT,M+1),VCO1S(ISTAT,M+2),VCO1S(ISTAAR 20000
     1T,M))                                                                     AR 20100
      TCO2S(ISTAT) = FINTP2(TCO1S(ISTAT,M  +1),TCO1S(ISTAT,M  +2),              AR 20200
     1TCO1S(ISTAT,M))                                                           AR 20300
 3490 SS(NIINT) = FINTP2(S(ISTAT,M+1),S(ISTAT,M+2),S(ISTAT,M))                  AR 20400
   10 IF(                )420,1307,420                                          AR 20500
  420 AREAS(NIINT)=AREA2S(ISTAT)/2.0                                            AR 20600
      TCOSS(NIINT)=TCO2S(ISTAT)                                                 AR 20700
      VCOSS(NIINT)=VCO2S(ISTAT)                                                 AR 20800
 3108 SINE2=-SINE2                                                              AR 20900
      NIINT=NIINT+1                                                             AR 21000
  400 CONTINUE                                                                  AR 21100
C       END OF AREA SOLUTION                                                    AR 21200
C       FIND FINAL INTERSECTION                                                 AR 21300
      IF(IITEST-3) 8000,8003,8001                                               AR 21400
 8001 IITEST=2                                                                  AR 21500
 8000 IF(NIINT-1)      4250,4250,4251                                           AR 21600
 4250 GO TO(6150,6150,6150,6151),K 7                                            AR 21700
 4251 IF(INIINT / 2)* 2 - NIINT)  201,202,201                                   AR 21800
  201 NIINT=NIINT-1                                                             AR 21900
      GO TO 812                                                                 AR 22000
  202 GO TO (2002,2003,2003,2003),K7                                            AR 22100
 2002 YSS(NIINT) = ABS(M(ISTAT) - Z(ISTAT,LSTOP))/SLOPE                         AR 22200
      ZSS(NIINT)=Z(ISTAT,LSTOP)                                                 AR 22300
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      AREASS(N1INT)=AREAIS(ISTAT,LSTOP)     /2.0                          AR 22400
      TCOSS(N1INT)=TCOIS (ISTAT,LSTOP)                                    AR 22500
      VCOSS(N1INT)=VCOIS(ISTAT,LSTOP)                                     AR 22600
      GO TO 512                                                           AR 22700
 6160 AREAZS(ISTAT)=AREAIS(ISTAT,LSTOP)     /2.0                          AR 22800
      TCOZS(ISTAT)=TCOIS (ISTAT,LSTOP)                                    AR 22900
      VCOZS(ISTAT)=VCOIS(ISTAT,LSTOP)                                     AR 23000
      GO TO 7000                                                          AR 23100
 6161 AREAZS(ISTAT)=0.0                                                   AR 23200
      TCOZS(ISTAT)=0.0                                                    AR 23300
      VCOZS (ISTAT)=0.0                                                   AR 23400
      GO TO 7000                                                          AR 23500
 2003 IF(SINE1) 2002,2004,2004                                            AR 23600
 2004 ZSS(N1INT)= H(ISTAT)                                                AR 23700
      YSS(N1INT)=0.0                                                      AR 23800
      I1TEST=3                                                            AR 23900
      ISTART=LSTOP                                                        AR 24000
      GO TO 3103                                                          AR 24100
C     CORRECTIONS AND SUMMATION FOR ONE SIDE                             AR 24200
 3119 N1INT=N1INT-1                                                       AR 24300
      IF(SINE1  )      804,804,802                                        AR 24400
 804  IF(ABS(YSS(1))-0.0001) 802,802,801                                  AR 24500
 801  AREAZS(ISTAT)=0.0                                                   AR 24600
      TCOZS(ISTAT)=0.0                                                    AR 24700
      VCOZS(ISTAT)=0.0                                                    AR 24800
      GO TO 803                                                           AR 24900
 802  AREAZS(ISTAT)=AREASS(1)                                             AR 25000
      VCOZS(ISTAT)=VCOSS(1)                                               AR 25100
      TCOZS(ISTAT)=TCOSS(1)                                               AR 25200
 803  DO 800 I=1,N1INT                                                    AR 25300
C     EVEN OR ODD GROUP                                                  AR 25400
      IF((I/2)*2-I)811,810,811                                            AR 25500
 810  IF (SINE1  )      800,808,8                                         AR 25600
 808  VCOZS(ISTAT)=(VCOZS(ISTAT)*AREAZS(ISTAT)-AREASS(I)*VCOSS(I)         AR 25700
     1*VCOSS(I+1)*AREASS(I+1))/(AREAZS(ISTAT)-AREASS(I)+AREASS(I+1))      AR 25800
      TCOZS(ISTAT)=(TCOZS(ISTAT)*AREAZS(ISTAT)-AREASS(I)*TCOSS(I)*        AR 25900
     1TCOSS(I+1)*AREASS(I+1))                                             AR 26000
     2                        /(AREAZS(ISTAT)-AREASS(I)*AREASS(I+1))     AR 26100
      AREAZS(ISTAT)=AREAZS(ISTAT)-AREASS(I)*AREASS(I+1)                   AR 26200
      GO TO 800                                                           AR 26300
C     ODD GROUP                                                          AR 26400
C     COMPUTE TRAPZOID                                                   AR 26500
 811  A1CORR=(YSS(I+1)+YSS(I))*(ZSS(I+1)-ZSS(I))/2.                      AR 26600
 800  T1CORR=((ZSS(I+1)-ZSS(I))/2.0)*((YSS(I)**2)+(YSS(I+1)-YSS(I))*(YSSAR 26700
     1(I)+(YSS(I+1)-YSS(I))/3.0))                                         AR 26800
      V1CORR=((ZSS(I+1) - ZSS(I))**2 ) * ( YSS(I)/2. + (YSS(I+1)         AR 26900
     1- YSS(I))/3.)           )*ZSS(I)  *A1CORR                          AR 27000
C                                                                        AR 27100
      IF (SINE1  )         807,809,809                                   AR 27200
 807  A1CORR=AREASS(I+1)-AREASS(I)-A1CORR                                 AR 27300
      T1CORR=                                                            AR 27400
     1      AREASS(I+1)*TCOSS(I+1)-AREASS(I)*TCOSS(I)-   T1CORR          AR 27500
      V1CORR=                                                            AR 27600
     1       AREASS(I+1)*VCOSS(I+1)-AREASS(I)*VCOSS(I)- V1CORR           AR 27700
 809  TCOZS(ISTAT)=(TCOZS(ISTAT)*AREAZS(ISTAT)+       T1CORR)/(AREASS(ISAR 27800
     1TAT)+A1CORR)                                                        AR 27900
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      VCOZS(ISTAT)=(VCOZS(ISTAT)*AREAZS(ISTAT)*        VICORR)/(AREAZS(ISAR 28000
     1TAT)+AICORR)                                                        AR 28100
      AREAZS(ISTAT)=AREAZS(ISTAT)+AICORR                                  AR 28200
  500 CONTINUE                                                            AR 28300
C       END LOGIC                                                       AR 28400
 7000 CONTINUE                                                          AR 28500
      IF(SINE1)      7001,7002,7002                                     AR 28600
 7002 AREA2S=AREAZS(ISTAT)                                               AR 28700
      TCO2S=TCOZS(ISTAT)*(-SINE1)                                        AR 28800
      VCO2S=VCOZS(ISTAT)                                                 AR 28900
      SINE1=-1.0                                                         AR 29000
      SINE2=+1.0                                                         AR 29100
      NIINT=1                                                            AR 29200
      IITEST=2                                                           AR 29300
      GO TO (3110,880,890),ICAT                                          AR 29400
  880 YIINT(1,ISTAT) = YSS(1)                                            AR 29500
      GO TO 3110                                                         AR 29600
  890 II = ISTAT-NSTAT                                                   AR 29700
      YIINT(3,II) = YSS(1)                                               AR 29800
      GO TO 3110                                                         AR 29900
 7001 AREA7S=AREAZS(ISTAT)+ARLA2S                                        AR 30000
      IF(ABS(AREA7S) -.001)7006,7006,7009                                AR 30100
 7009 TCOZS(ISTAT)=(TCO2S*ARLA2S+TCOZS(ISTAT)*AREAZS(ISTAT))/AREA7S      AR 30200
      VCOZS(ISTAT)=(VCO2S*ARLA2S+VCOZS(ISTAT)*AREAZS(ISTAT))/AREA7S      AR 30300
      AREAZS(ISTAT)=AREA7S                                               AR 30400
      TCOZS(ISTAT)=TCOZS(ISTAT)*THET2M/ABS(THET2M)                       AR 30500
 7007 THET1M=THET2M                                                      AR 30600
 1307 XZS(ISTAT) = X(ISTAT)                                              AR 30700
      IF(ICAT-2)777,778,779                                              AR 30800
  778 S1 = SZS(ISTAT)                                                    AR 30900
      AREA= AREAZS(ISTAT)                                                AR 31000
      TCO = TCOZS(ISTAT)                                                 AR 31100
      VCO = VCOZS(ISTAT)                                                 AR 31200
      IF(ABSF(THET1M)-.0001)667,667,668                                  AR 31300
  668 YIINT(2,ISTAT) = YSS(2)                                            AR 31400
  667 ICAT = 3                                                           AR 31500
      ISTAT = ISTAT + NSTAT                                              AR 31600
      GO TO 222                                                          AR 31700
  779 VCOZS(I2)    =(VCO*AREA-VCOZS(ISTAT)*AREAZS(ISTAT))/(AREA-AREAZS(ISAR 31800
     1TAT))                                                              AR 31900
      TCOZS(I2)    =(TCO*AREA-TCOZS(ISTAT)*AREAZS(ISTAT))/(AREA-AREAZS(ISAR 32000
     1TAT))                                                              AR 32100
      AREAZS(I2)    =AREA-AREAZS(ISTAT)                                  AR 32200
      SZS(I2)    =S1+SZS(ISTAT) -2.0*S(ISTAT,1)                          AR 32300
      ICAT=2                                                             AR 32400
      ISTAT = ISTAT-NSTAT                                                AR 32500
      IF(ABSF(THET1M)-.0001)777,777,668                                  AR 32600
  669 YIINT(4,ISTAT) = YSS(2)                                            AR 32700
  777 M = MM                                                             AR 32800
      RETURN                                                             AR 32900
 7006 AREAZS(ISTAT)=0.0                                                  AR 33000
      TCOZS(ISTAT) = 0.0                                                 AR 33100
      VCOZS(ISTAT) = 0.0                                                 AR 33200
      GO TO 7007                                                         AR 33300
      END                                                                AR 33400
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      SUBROUTINE BAL                                                    BA   400
      DIMENSIONAIWP3(20),AREA1S(60,29),AREA2S(60),AREA4S(20,30),BML(20),DI   200
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   300
     1DWL(20),H(60),HICOMP(20),HIHOU(60),HIMAR(60),HIOUT(20),HIBAD(60),HDI   400
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   500
     1AME1S(8),NCOMP2(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   600
      DIMENSIONPERM2(10),RAD(5,5,10),S(60,29),S2R(60),S3RMIP(20),STATNO(DI   700
     160),SECTIM(25),TCM1C(25),TCM2(5,5,10),TCQ1S(60,29),TCQ2S(60),THETSDI   800
     1M(10),TPI(20),TRIM3(6),VCM1C(25),VCM2(5,5,10),VCQ1S(60,29),VCQ2S(6DI   900
     10),VOL3(20),VOL5(5),VOL1C(25),WEIGHT(25),X(60),XIDAM(30),XIDAM2(10DI  1000
     1),XIDAM3(20),XP2DAM3(20),XIW(25),XP2DAM(30),XP2DAM2(10)           DI  1100
      DIMENSIONXPS(60),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCB1C(25DI  1200
     1),XLCB3(20),XLCF3(20),XLCQ1W(25),XLCQ5(5),XMTI(20),Y(60,29),YI(60)DI  1300
     1,Z(60,25) ,YIINT(4,30),THETJM(5)                                  DI  1400
      DIMENSION XLVM(25)                                                DI  1490
      COMMON/1/AIMA,AIWP,AIWP3,AREA1S,AREA2S,AREA4S,BML,BMT,CIA,CIALPH,CDI  1500
     11B,C1C,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  1600
     1,H2COMP,HIHOU,HIMAR,HIOUT,HIBAD,H2MAR,H3MAR,H4MAR,HWI,IIAFT,IIBAL,DI  1700
     1II1FWD,IISYM,IIWC,IIWH,IIWL,I2WC,I2WH,I2WL,IBREAK,ICOMP,ICHECK,INITDI  1800
     1,ISENTL,ISFANO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI  1900
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIHUTT,NIDSPL,NIHEEL,NILCGDI  2000
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2100
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAD,S,S1SHIP,S2R,S3RMIDI  2200
     1P,SPACE,STATNO,SECTIM,TCB,TCM1C,TCM2,TCQ1S,TCQ2S,THETIM,THETIT,THEDI  2300
     1T2T,THETSM,TPI,TRIM3,VCM1C,VCM2,VCQ1S,VCQ2S,VOL                   DI  2400
      COMMON/3/VOL1C,VOL1D,VOL3,VOL5,WAVCRN,WEIGHT,WHIINC,WHIMUL,DI     2500
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XP2DAM,XP2DAM2,XP2LIM,XP2S,XPLIM,XDI  2600
     14LIM,XTIL,XTIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCB1C,XLCB3,XLDI  2700
     1CF,XLCF3,XLCQ,XLCQ1W,XLCQ5,XLMBIR,XLMBDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  2800
     1,YI,YIMA,Z,WAVLOC ,XIDAM5,XP2DAM5,XLMB2R,IBAL                     DI  2900
      COMMON/4/IÇAT,YIINT,NJHEEL,THETJM,LIMIT                           DI  3000
      DIMENSION  XIS(30),YIS(30,29),ZIS(30,99),YIST(2,29),ZIST(2,29),   DI   200
     1ZINT(4,10),YINT(4,10),XBLK(4),NINT(4),NPIS(30),YBPIS(30,10),      DI   300
     2JBPST(2,10),NPIST(2)                                              DI   400
      COMMON XIS,YIS,ZIS,XBLK,YINT,ZINT,NPIS,NINT,YIS1,ZIST,NPIST,JBPIS,DI   500
     1JBPST,INDXJ,JSTAT,KSTAT,LSTAT,MSTAT,NBLK,LBULK,JCAT               DI   600
C                                                                       BA   800
      IFSUNK=1                                                          BA   800
      ASSIGN 190 TO IOPTN                                               BA   600
      ASSIGN 30 TO INDRFT                                               BA   700
C                                                                       BA   800
C         DECIDE WHETHER SHIP IS TO BE BALANCED ASSUMING-               BA   900
C           1)TRIAL VALUES FOR INPUT PARAMETERS,I.E.,IBAL=1             BA  1000
C           2)PREVIOUS FINAL VALUES,I.E.,IBAL=2                         BA  1100
C           3)CONSTANT TRIM AND TRIAL VALUES FOR OTHER PARAMS.(IBAL=3)  BA  1200
C           4)THAT THE PRECEDING ATTEMPT TO BALANCE FAILED,I.E.,IIBAL=4 BA  1300
C                                                                       BA  1400
      GO TO(10,30,20,5),IIBAL                                           BA  1500
C                                                                       BA  1600
C         IF PRECEDING ATTEMPT FAILED,RESET PARAMETERS AND RECOMPUTE    BA  1700
C         DRAFTS BEFORE PROCEDING.                                      BA  1800
C                                                                       BA  1900
    5 ASSIGN 26 TO INDRFT                                               BA  2000
      IIBAL=1                                                           BA  2100
   10 THETIT=0.0                                                        BA  2200
      GO TO 33                                                          BA  2300
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   20 ASSIGN 290 TO IOPTN                                                  HA  2400
   21 HIBASC=10.0                                                          HA  2500
      XLCB1=-1000.0                                                        HA  2600
      VOL2=-10.0                                                           HA  2700
      GO TO (DRAFT,(26,30)                                                 HA  2800
   26 CALL DRAFT                                                           HA  2900
C                                                                          HA  3000
C          DETERMINE WHETHER SHIP CAN BE BALANCED                          HA  3100
C                                                                          HA  3200
   30 IF(THETIT)40,60,50                                                   HA  3300
   40 JJ=NSTAT                                                             HA  3400
      GO TO 60                                                             HA  3500
   50 JJ=1                                                                 HA  3600
   60 IF((H(JJ)-HIMAR(JJ))*COS(THETIT)*COS(THETIH) - 0.0) 70,80,80         HA  3700
   70 IF(THETIT-0.0) 90,80,80                                              HA  3800
   80 IIMAL=6                                                              HA  3900
      GO TO 290                                                            HA  4000
   90 GO TO (95,275),,IFSUNK                                               HA  4050
C                                                                          HA  4100
C          BEGIN ITERATIVE SEARCH FOR DRAFT GIVING CORRECT DISPLACEMENT    HA  4200
C                                                                          HA  4300
   95 CALL VOLUME                                                          HA  4400
      WRITE(10,1000) HIBASC,THETIT,VOL,VOLID,XLCH,XLCB                     HA  4500
      ISIG=1                                                               HA  4600
  100 IF(ABS(VOLID-VOL)-.001*VOLID) 180,180,110                            HA  4700
C                                                                          HA  4800
C          MAKE INCREMENTAL CORRECTION TO DRAFT                            HA  4900
C                                                                          HA  5000
  110 IF(VOL2) 130,120,120                                                 HA  5100
  120 IF(ABS(VOL2-VOL) - 1.0) 130,130,140                                  HA  5200
  130 DELTIH=10.0*(VOLID-VOL)/VOLID                                        HA  5300
      GO TO 150                                                            HA  5400
  140 DELTIH=ABS(DELTIH)*(VOLID-VOL)/ABS(VOL2-VOL)                         HA  5500
  150 IF(ABS(DELTIH)-0.1*SQRT(XLBP)) 170,170,160                           HA  5600
  160 DELTIH=.1*SQRT(XLBP)*(VOLID-VOL)/ABS(VOLID-VOL)                      HA  5700
  170 HIBASC=HIBASC+DELTIH                                                 HA  5800
      VOL2=VOL                                                             HA  5900
      IFSUNK=1                                                             HA  5950
      GO TO 30                                                             HA  6000
C                                                                          HA  6100
  180 GO TO IOPTN,(190,290)                                                HA  6200
C                                                                          HA  6300
C          BEGIN ITERATIVE SEARCH FOR TRIM GIVING CORRECT LCB.             HA  6400
C                                                                          HA  6500
  190 GO TO(200,290),,ISIG                                                 HA  6600
  200 IF(ABS(XLCB-XLCG)- 0.1) 280,280,210                                  HA  6700
C                                                                          HA  6800
C          MAKE INCREMENTAL CORRECTION TO TRIM.                            HA  6900
C                                                                          HA  7000
  210 IF(XLCB1+1000.0) 230,230,220                                         HA  7100
  220 IF(ABS(XLCB1-XLCB) - 0.01) 230,230,240                               HA  7200
  230 DELTIT=(XLCB-XLCG)*12.0*HIBASC/((XLBP**2)/2.0)                       HA  7300
      GO TO 250                                                            HA  7400
  240 DELTIT=ABS(DELTIT)*(XLCB-XLCG)/ABS(XLCB1-XLCB)                       HA  7500
  250 IF(ABS(DELTIT)-ATAN(1.0/XLBP)) 270,270,260                           HA  7600
  260 DELTIT=(ATAN(1.0/XLBP))*(XLCB-XLCG)/ABS(XLCB-XLCG)                   HA  7700
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  270 THETIT=THETIT+DELTIT                                          BA  7890
      XLCB1=XLCB                                                    BA  7900
      IFBUNK=2                                                      BA  7950
      GO TO 30                                                      BA  7960
  275 CALL VOLUME                                                   BA  8000
      WRITE(10,1000) MIBASC,THETIT,VOL,VOLIN,XLCB,XLCO              BA  8100
      GO TO 200                                                     BA  8200
  280 ISIG=2                                                        BA  8300
      GO TO 100                                                     BA  8400
C                                                                   BA  8500
  290 RETURN                                                        BA  8600
 1000 FORMAT(10X,6(E12.4,2X))                                       BA  8700
      END                                                           BA  8800
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      SUBROUTINE COEFIC                                                 CO   200
      DIMENSION Z1(3)                                                   CO   300
      DIMENSIONAIWP3(20),AREAIS(60,20),AREAWS(60),AREAAS(20,30),BML(20),DI   400
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL3(20),DI   500
     1DWL(20),H(60),HICOMP(20),HIHOU(60),HIMAH(60),HIOUT(20),HISAS(60),HDI   600
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   700
     1AMEIS(8),NCOMPP(2,3,3),NP(60),PERM(1W),PERM1(1)                   DI   800
      DIMENSIONPERMP(1W),HAB(8,5,10),S(60,20),SPS(60),SIGHIP(20),STATNO(DI   900
     160),SECTIM(20),TCRIC(20),TCWS(8,5,10),TCOIS(60,20),TCOPS(60),THETHDI  1000
     1M(10),TPI(20),TRIMJ(6),VCRIC(20),VCRS(8,5,10),VCOIS(60,20),VCOPS(6DI  1100
     10),VOL3(20),VOLS(8),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAM2(10DI  1200
     1),XIDAM6(20),X3DAM6(20),XIW(20),X2DAM(30),X2DAM2(10)              DI  1300
      DIMENSIONXBS(20),XKW3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCWIC(20DI  1400
     1),XLCW3(20),XLCP3(20),XLCOIW(20),XLCOS(8),XMTI(20),Y(60,20),YI(60)DI  1500
     1,Z(60,20),YLINT(4,30),THETJM(8)                                   DI  1600
      DIMENSION XLVM(20)                                                DI  1700
      COMMON/1/AIMA,AIWP,AIWP3,AREAIS,AREAZS,AREAAS,BML,BMT,CIA,CIALPH,CDI  1800
     11B,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIMABC,HICOMPDI  1900
     1,HICOMP,HIHOU,HIMAH,HIOUT,HISAS,HJMAH,HKMAH,HWI,IIAFT,IIMAL,DI  2000
     1IIPWD,IISYM,IIWC,IIWH,IIWL,I2WC,I2WH,I2WL,IBREAK,ICOMP,ICHECK,INITDI  2100
     1,ISENTL,ISENNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI  2200
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MMA,NIAUTT,NIOSPL,NIWLEL,NILCODI  2300
     1,NIPERM,NITRIM,NAME,NAMEIS,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2400
     1TAT2,NSTAT3,NSTAT6,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SIGHIP,SPS,SIGHIDI  2500
     1P,SPACE,STATNO,SECTIM,TCO,TCOIC,TCOS,TCOIS,TCOPS,THETIM,THETIT,THEDI  2600
     1TAT,THETJM,TPI,TRIMJ,VCWIC,VCWS,VCOIS,VCOPS,VOL                   DI  2700
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCFN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2800
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,X2DAM,X2DAM2,XPLIM,XBS,X3LIM,XDI  2900
     14LIM,XIIL,XIIT,XKW,XKW3,XKML,XKMT,XLIDAM,XLHP,XLCW,XLCWIC,XLCW3,XLDI  3000
     1CP,XLCP3,XLCO,XLCOIW,XLCOS,XLMRIW,XLMRDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  3100
     1,YI,YIMA,Z,WAVLOC ,XIDAM6,X2DAM6,XLMBPR,IABAL                     DI  3200
      COMMON/4/ICAT,YLINT,NJWLEL,THETJM,LIMIT                           DI  3300
      IF(ITEST1)110,100,100                                             CO  3400
  110 SLOPE = (Y(ISTAT,IY+1)-Y(ISTAT,IY))/(Z(ISTAT,IY+1)-Z(ISTAT,IY))   CO  3500
  120 CONST = Y(ISTAT,IY)-SLOPE*Z(ISTAT,IY)                             CO  3600
      Y(ISTAT,IY+2) = Y(ISTAT,IY+1)                                     CO  3700
      Z(ISTAT,IY+2) = Z(ISTAT,IY+1)                                     CO  3800
      Z(ISTAT,IY+1) = (Z(ISTAT,IY+2) + Z(ISTAT,IY))/2.0                 CO  3900
      Y(ISTAT,IY+1) = SLOPE*Z(ISTAT,IY+1) + CONST                       CO  4000
      JBREAK(ISTAT,IBREAK) = IY+2                                       CO  4100
      ITEST1 = 0                                                        CO  4200
      IF(JBREAK(ISTAT,IBREAK) - NP(ISTAT)) 100,101,101                  CO  4300
  101 NP(ISTAT) = NP(ISTAT) + 1                                         CO  4400
  100 DO 10 I = 1,3                                                     CO  4500
      J = M-I+1                                                         CO  4600
      Y1(I) = Y(ISTAT,J)                                                CO  4700
   10 Z1(I) = Z(ISTAT,J)                                                CO  4800
   20 C1    = Y1(1)-Y1(2)                                               CO  4900
      C2    = Z1(1)**2 - Z1(2)**2                                       CO  5000
      C3    = Z1 (1)-Z1(2)                                              CO  5100
      C4    = Y1(1)-Y1(3)                                               CO  5200
      C5    = Z1(1)**2 - Z1(3)**2                                       CO  5300
      C6    = Z1(1)-Z1(3)                                               CO  5400
      C1A   =(C1*C6-C3*C4)/(C2*C6-C3*C5)                                CO  5500
      C1B   =(C1-C1A*C2)/C3                                             CO  5600
      C1C   = Y1(1)- C1A*Z1(1)**2 - C1B*Z1(1)                           CO  5700
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      IF(ITEST1 - 1)90,40,90                                                CO  5700
   40 Z1(1)  = ZT(2)                                                        CO  5800
      Z1(2) =Z1(2) + (Z1 (3)-Z1(2))/2.0                                     CO  5900
      Y1(1)  =Y1(2)                                                         CO  6000
      Y1(2)  =FINTP1(Z1(2),C1A,C1B,C1C)                                     CO  6100
      DO 30 J=1,3                                                           CO  6200
      J = M+1                                                               CO  6300
      Y(ISTAT,J) = Y1(1)                                                    CO  6400
   30 Z(ISTAT,J) = Z1(1)                                                    CO  6500
      JBREAK(ISTAT,IBREAK) = IY+2                                           CO  6600
      IF(JBREAK(ISTAT,IBREAK)-NP(ISTAT))32,90,31                            CO  6700
   31 NP(ISTAT) = NP(ISTAT) + 1                                             CO  6800
      JBREAK(ISTAT,IBREAK) = NP(ISTAT)                                      CO  6900
   32 ITEST1 = 0                                                            CO  7000
      GO TO 20                                                              CO  7100
   50 IF(ABS(Z1(3)+Z1(1)-2.0*Z1(2))-0.02) 40 ,60,800                        CO  7200
  800 IF (Z1(3) + Z1(1)- 2.0* Z1(2)) 70,60,70                               CO  7300
   70 Z(ISTAT,M+1) = (Z1(1) + Z1(3))/2.0                                    CO  7400
      Y(ISTAT,M+1)= FINTP1(Z(ISTAT,M+1),C1A,C1B,C1C)                        CO  7500
   60 IF(Y(ISTAT,IY+1)-,5)120,60,60                                         CO  7600
  120 ITEST1 = 456                                                          CO  7700
      KK=0                                                                  CO  7800
      WRITE (6,806)(NAME(I) , I = 1,8), ISERNO, (DATE(I), I = 1,2)          CO  7900
  806 FORMAT(6H1SHIP-4X8A6,5X14HSERIAL NUMBER-I4,5X5HDATE-2A6)              CO  8000
      WRITE (6,1100)STATNO(ISTAT),M                                         CO  8100
   60 RETURN                                                                CO  8200
 1100 FORMAT(34H DATA SUBMISSION ERROR AT STATION F8.3, 13H AROUND POINTCO  8300
     1I3, 43H.  A NEGATIVE OFFSET HAS BEEN INTERPOLATED,/     120H SHIP CO  8400
     2DATA TABLE OF INTERPOLATED OFFSETS,AREAS,VCG,TCG, AND GIRTH WILL BCO  8500
     3E COMPLETED BUT THE PROGRAM WILL NOT BE EXECUTED  //  97H A BREAKPCO  8600
     4OINT IS PROBABLY MISSING.  CHECK DATA AT STATION  INDICATED AND THCO  8700
     5E INPUT INSTRUCTIONS.  //  99H RESUBMIT THE DATA USING THE SAME SHCO  8800
     6IP SERIAL NUMBER AS THE SHIP DATA TABLE WAS NOT STORED ON TAPE.)   CO  8900
   90 STOP 11111                                                            CO  9000
      END                                                                   CO  9100
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      SUBROUTINE COEFII(X1,X2,X3,XI)                                    CO   200
      DIMENSIONAIWP1(20),AREA1S(60,20),AREA2S(60),AREA3S(20,30),BML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL1(20),DI   400
     1DWL(20),M(60),MICOMP(20),MIMOO(60),MIMAH(60),MIOUT(20),MISAB(60),MDI   500
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   600
     1AME1S(8),NCOMP2(2,3,3),NP(60),PERM(18),PERM1(3)                   DI   700
      DIMENSIONPERM2(18),HAB(5,5,10),S(60,20),S2S(60),S3SHIP(20),STATNO(DI   800
     160),SECTIM(25),TCB1C(25),TCB3(5,5,10),TCO1S(60,20),TCO2S(60),THETSDI   900
     1M(10),TPI(20),TRIM3(6),VCB1C(25),VCB3(5,5,10),VCO1S(60,20),VCO2S(6DI  1000
     10),VOL1(20),VOL3(5),VOL1C(25),WEIGHT(25),X(60),XIDAM(30),XIDAM2(10DI  1100
     1),XIDAM3(20),X2DAM3(20),XIW(20),X2DAM(30),X2DAM2(10)              DI  1200
      DIMENSIONXPS(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCB1C(25DI  1300
     1),XLCB3(20),XLCP3(20),XLCO1W(25),XLCO3(5),XMTI(20),Y(60,20),YI(60)DI  1400
     1,Z(60,20),YIINT(6,30),THETSM(5)                                   DI  1500
      DIMENSION XLVM(25)                                                DI  1600
      COMMON/1/AIMA,AIWP,AIWP1,AREA1S,AREA2S,AREA3S,BML,BMT,CIA,CIALPH,CDI  1700
     11B,C1C,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL1,DWL,M,MIMAB,MICOMPDI  1800
     1,M2COMP,MIMOO,MIMAH,MIOUT,MISAB,M2MAB,M3MAB,M4MAB,MWI,NIAFT,NIMAI,DI  1900
     1IIFWD,IIBYM,IIWC,IIWM,IIWL,I2WC,I3WM,I3WL,IMBEAK,ICOMP,ICHECK,INITDI  2000
     1,ISENTL,ISFRNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIMEEL,NILCODI  2200
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,HAB,S,S1SHIP,S2S,S3SHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCB,TCB1C,TCB3,TCO1S,TCO2S,THETIM,THETIT,THEDI  2500
     1T2T,THETSM,TPI,TRIM3,VCB1C,VCB3,VCO1S,VCO2S,VOL                   DI  2600
      COMMON/3/VOL1C,VOL1D,VOL3,VOL5,WAVCFN,WC1INC,WEIGHT,WM1INC,WM1MUL,DI  2700
     1WL1INC,X,X1DAM,X1DAM2,X1LIM,X1M,X1W,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI  2800
     1GLIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLOP,XLCB,XLCB1C,XLCB3,XLDI  2900
     1CP,XLCP3,XLCO,XLCO1W,XLCO3,XLMB1R,XLMBDA,XMID,XMOM1L,XMOMJV,XMTI,YDI  3000
     1,YI,YIMA,Z,WAVLOC ,X1DAM5,X2DAM5,XLMBDR,IABAL                     DI  3100
      COMMON/4/ICAT,YIINT,NJHEEL,THETJM,LIMIT                           DI  3200
      U    =(X1-X2)/(X2-X1)                                             CO  3300
      ALPH =(X3-X2)/(X2-X1)                                             CO  3400
      C1A = (U**2 + U)/(ALPH**2 + ALPH)                                 CO  3500
      C1C = (ALPH*U**2-U*ALPH**2)/(ALPH**2 + ALPH)                      CO  3600
      C1B =(ALPH-U+U*ALPH-U**2)/ALPH                                    CO  3700
      RETURN                                                            CO  3800
      END                                                               CO  3900
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      SUBROUTINE CMPRTMNT                                                CM   200
      DIMENSIONA1WP3(20),AREA1S(60,29),AREA2S(60),AREA4S(20,30),BML(20),DI   200
     1BMT(20),C1ALPH(20),C1P(20),C1WP(20),C1DOFT(20),DATE(2),DISPL3(20),DI   300
     1DWL(20),H(60),H1COMP(20),H1HOG(60),H1MAR(60),H1OUT(20),H1SAG(60),HDI   400
     1RCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   500
     1AME1S(8),NCOMP2(2,3,3),NP(50),PERM(18),PERM1(3)                   DI   600
      DIMENSIONPERM2(18),RAS(5,5,10),S(60,29),S2S(60),S3SHIP(20),STATNO(DI   700
     160),SECTIM(20),TC01C(20),TC0S(5,5,10),TC01S(60,29),TC02S(60),THETSDI   800
     1M(10),TPI(20),TRIM3(6),VCM1C(20),VCMS(5,5,10),VC01S(60,29),VC02S(6DI   900
     10),VOL3(20),VOLS(5),VOL1C(20),WEIGHT(20),X(60),X1DAM(30),X1DAM2(10DI  1000
     1),X1DAM6(20),X2DAM6(20),X1W(20),X2DAM(30),X2DAM2(10)              DI  1100
      DIMENSIONX2S(60),XKMJ(20),XKML(20),XKMT(20),XL1DAM(30,3),XLC01C(20DI  1200
     1),XLCM3(20),XLC23(20),XLC01W(20),XLC0S(5),XMTI(20),Y(60,29),Y1(60)DI  1300
     1,Z(60,29),YINT(4,30),THETJM(5)                                    DI  1400
      DIMENSION XLVM(20)                                                 DI  1490
      COMMON/1/A1MA,A1WP,A1WPJ,AREA1S,AREA2S,AREA4S,BML,BMT,C1A,C1ALPH,CDI  1500
     11B,C1C,C1P,C1DOFT,C1WP,CONST,DATE,DISPL,DISPL3,DWL,H,H1BASC,H1COMPDI  1600
     1,H2COMP,H1HOG,H1MAR,H1OUT,H1SAG,H2MAR,H3MAR,H4MAR,HWL,I1AFT,I1BAL,DI  1700
     1I1FWD,I1SYM,I1WC,I1WM,I1WL,I2WC,I2WM,I2WL,IBREAK,ICOMP,ICHECK,INITDI  1800
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  1900
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NINUT,NINSPL,NJHEEL,NJLCGDI  2000
     1,NJPERM,NJTRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2100
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAS,S,S1SHIP,S2S,S3SHIDI  2200
     1P,SPACE,STATNO,SECTIM,TC0,TC01C,TC0S,TC01S,TC02S,THETIM,THETIT,THEDI  2300
     1TAT,THETSM,TPI,TRIM3,VCM1C,VCMS,VC01S,VC02S,VOL                   DI  2400
      COMMON/3/VOL1C,VOL10,VOL3,VOL4,WAVCEN,WC1INC,WEIGHT,WM1INC,WM1MUL,DI  2500
     1WL1INC,X,X1DAM,X1DAM2,X1LIM,X1M,X1W,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI  2600
     14LIM,X1IL,X1IT,XKB,XKB3,XKML,XKMT,XL1DAM,XLBP,XLCB,XLCB1C,XLCB3),XLDI  2700
     1CF,XLCF3,XLC0,XLC01W,XLC0S,XLMB1R,XLMRDA,XMID,XMOMTL,XMOMJV,XMTI,YDI  2800
     1,Y1,Y1MA,Z,WAVLOC,X1DAM6,X2DAM6,XLMBPR,IARAL                      DI  2900
      COMMON/4/ICAT,YINT,NJHEEL,THETJM,LIMIT                             DI  3000
      DIMENSION  XIS(30),YIS(30,29),ZIS(30,29),YIST(2,29),ZIST(2,29),    DI  3100
     1ZINT(4,10),YINT(4,10),XBLK(4),NINT(4),NPIS(30),JBPIS(30,10),      DI  3200
     2JBPST(2,10),NPIST(2)                                              DI  3300
      COMMON XIS,YIS,ZIS,XBLK,YINT,ZINT,NPIS,NINT,YIS1,ZIST,NPIST,JBPIS,DI  3400
     1JBPST,INDX3,JSTAT,KSTAT,LSTAT,MSTAT,NBULK,LBULK,JCAT              DI  3500
      COMMON /5/ JSERNO                                                  CM   3600
      JSERNO=ISERNO                                                      CM   3700
      READ(60,1002) NCOMP1                                               CM   3800
      DO 900 JCOMP = 1,NCOMP1                                            CM   3900
      IF(JCOMP-1)20,20,10                                                CM   4000
   10 ISERNO=JSERNO                                                      CM   4100
      INIT=0                                                             CM
      ITEST1=2                                                           CM
      KK=1                                                               CM
      DO 14 I=1,30                                                       CM
      DO 12 J=1,29                                                       CM
      ZIS(I,J)=0.                                                        CM   4500
      YIS(I,J)=0.                                                        CM   4600
      Y(I,J)=0.                                                          CM   4700
   12 Z(I,J)=0.                                                          CM   4800
      DO 13 J=1,10                                                       CM   4900
      JBPIS(I,J) = 0                                                     CM   5000
      JBREAK(I,J)=0                                                      CM   5100
      DO 13 K=1,4                                                        CM   5200
      ZINT(K,J)=0.                                                       CM   5300
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      YINT(K,J)=0.                                                      CM  2400
   13 CONTINUE                                                          CM  2500
      NP(I)=0                                                           CM  2600
      NPIS(I)=0                                                         CM  2700
      X(I)=0.                                                           CM  2800
   14 XIS(I) =0.                                                        CM  2900
      CALL OFFSET                                                       CM  3000
   20 READ(60,1000) ISERNO,NAME(8,DATE,ITEST),IWIT,IISYM,NBULK          CM  3100
      DO 22 I = 1,NBULK                                                 CM  3200
      READ(60,1002) NINT(I),XBLK(I)                                     CM  3300
      NPT=NINT(I)                                                       CM  3400
      READ(60,1003)(PINT(I,IPI), YINT(I,IPT),IPT=1,NPT)                 CM  3500
   22 CONTINUE                                                          CM  3600
      DO 28 J=1,10                                                      CM  3700
   28 JBPIS(I,J)= 0                                                     CM  3800
      JCAT=1                                                            CM  3900
      NPT = NINT(I)                                                     CM  4000
      DO 25 I=1,NBULK                                                   CM  4100
      IF(NINT(I)-3) 23,23,21                                            CM  4200
   21 NPT= NINT(I)-1                                                    CM  4300
   23 DO 24 J=2,NPT                                                     CM  4400
      IF(ZINT(I,J)-ZINT(I,J-1)) 24,24,24                                CM  4500
   26 IF(ABS(YINT(I,J))-.01)24,24,27                                    CM  4600
   27 JCAT = 2                                                          CM  4700
      GO TO 400                                                         CM  4800
   24 CONTINUE                                                          CM  4900
   25 CONTINUE                                                          CM  5000
  400 LSTAT=NSTAT                                                       CM  5100
   40 CALL GENERATE                                                     CM  5200
      NSTAT = LSTAT                                                     CM  5300
      ICAT=JCAT                                                         CM  5400
      LIMIT=NSTAT*ICAT                                                  CM  5500
   50 DO 60 I=1,LIMIT                                                   CM  5600
      NP(I)=NPIS(I)                                                     CM  5700
      X(I)=XIS(I)                                                       CM  5800
      NPT=NPIS(I)                                                       CM  5900
      DO 45 J = 1,10                                                    CM  6000
   45 JBREAK(I,J)=0                                                     CM  6001
      K=1                                                               CM  6002
      L=0                                                               CM  6100
      DO 57  J=1,NPT                                                    CM  6200
      L=L+1                                                             CM  6300
      IF(J-1)54,54,51                                                   CM  6400
   51 IF(J-JBPIS(I,K))54,52,54                                          CM  6500
   52 IF(J-1-JBPIS(I,K-1))54,53,54                                      CM  6600
   53 Z(1,L)=999999.0                                                   CM  6700
      L=L+1                                                             CM  6800
   54 Y(I,L)=YIS(I,J)                                                   CM  6900
      Z(I,L)=ZIS(I,J)                                                   CM  7000
      IF(J-JBPIS(I,K))57,55,57                                          CM  7100
   55 JBREAK(I,K) = 1                                                   CM  7200
      GO TO 57                                                          CM  7300
   56 K=K+1                                                             CM  7400
      GO TO 51                                                          CM  7500
   57 CONTINUE                                                          CM  7600
      NP(I) = L                                                         CM  7700
                                                                        CM  7710
```

```
      40 STATNO(I)= X(I)/ALOP                                          CM  7000
         ITEST(I)                                                      CM  0000
         INIT=1                                                        CM  0100
         KK=0                                                          CM  0200
         CALL OFFSET                                                   CM  0300
      900 CONTINUE                                                     CM  0400
         ISENNO = JSENNO                                               CM  0500
         RETURN                                                        CM  0600
 1000 FORMAT(1H ,10A4,813)                                             CM  0700
 1002 FORMAT(I8,F10.8)                                                 CM  0800
 1003 FORMAT(8F10.8)                                                   CM  0900
         END                                                           CM  1000
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      SUBROUTINE DAMAGE                                                 DA   0100
      DIMENSION DITRIM(4),DTHEEL(10),DTDRFT(8),LICOMP(20),LPCOMP(20,25) DA   0200
      DIMENSION TITLE(8),PERMB(20,25)                                   DA   0300
      DIMENSION NAME$S(8)                                               DA   0400
      DIMENSIONAIWP1(20),AREAIS(60,20),ARFAPS(60),AREAAS(20,30),BML(20),DI   0500
     1BMT(20),CIALPM(20),CIP(20),CIWP(20),CIDRFT(20),DATE(3),DISPL1(20),DI   0600
     1DWL(20),HI(60),HICOMP(20),HIMOD(60),HIMAR(60),HIOUT(20),HISAG(60),HDI  0700
     1NCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI  0800
     1AME1$(8),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   0900
      DIMENSIONPERMP(10),RAB(5,5,10),S(60,20),SPS(60),SSHIP(20),STATNO(DI   1000
     160),SECTIM(20),TCRIC(20),TCRS(5,5,10),TCOIS(60,20),TCOPS(60),THETSDI  1100
     1M(10),TPI(20),THIM3(4),VCRIC(20),VCRS(5,5,10),VCOIS(60,20),VCOPS(4DI  1200
     10),VOL3(20),VOIS(5),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAMP(10DI  1300
     11),XIDAMS(20),XPDAMS(20),XIW(20),XPDAM(30),XPDAMP(10)             DI   1400
      DIMENSIONXPS(60),XXBJ(20),XXML(20),XXMT(20),XLIDAM(30,3),XLCBIC(20DI  1500
     11),XLCRJ(20),XLCPJ(20),XLCOIW(20),XLCOM(8),XMTI(20),YI(60,20),Y(60)DI  1600
     1,Z(60,20) ,YLINT(4,30),THETSH(8)                                  DI   1700
      DIMENSION XLVM(20)                                                DI   1800
      COMMON/1/AIMA,AIWP,AIWPJ,AMEAIS,AREAPS,AMPAAS,BML,BMT,CIA,CIALPM,CDI   1900
     11B,CIC,CIP,CIDRFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HISAVG,NICOMPDI  2000
     1,HICOMP,HIMOD,HIMAR,HIOUT,HISAG,HJMAX,HKMAR,HW,IIAFT,IIMAL,DI   2100
     1111FWD,IISYM,IIWC,IIWM,IIWL,IJWC,IPWM,IPWL,IBREAK,ICOMP,ICMPRT,INITDI  2200
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI   2300
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIOSPL,NIWEEL,NILCGDI  2400
     1,NIPERM,NITRIM,NAME,NAMBIS,NCOMPI,NCOMPS,NNSTAT,NP,NSTAT,NSTAT1,NSGI  2500
     1TATP,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAD,S,SISHIP,SPS,SSHMIDI  2600
     1P,SPACE,STATNO,SECTIM,TCB,TCRIC,TCRS,TCOIS,TCOPS,THETIM,THETIT,THEDI  2700
     1TBI,THETSH,TPI,THIM3,VCMIC,VCRS,VCOIS,VCOPS,VOL                   DI   2800
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCRN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI   2900
     1WLIINC,X,XIDAM,XIDAMP,XILIM,XIM,XIW,XPDAM,XPDAMP,XPLIM,XPS,XSLIM,XDI  3000
     14LIM,XIIL,XIIT,XKR,XKRJ,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCBIC,XLCRJ,XLDI  3100
     1CF,XLCPJ,XLCO,XLCOIW,XLCOS,XLMRIM,XLMRDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  3200
     1,YI,YIMA,Z,WAVLOC ,XIDAMS,XPDAMS,XLMBDR,IABAL                     DI   3300
      COMMON/4/ICAT,YLINT,NDWEEL,THETDH,LIMIT                           DI   3400
      DATA (TITLE(1)=6HM FLOOD,(TITLE(2)=6HMPD    ),(TITLE(3)=6HVOLUME),DA   3500
     1(TITLE(4)=6HINTACT),(TITLE(5)=6H      ),(TITLE(6)=6HSHIP  )      DA   3600
      READ(5,9000)NSET                                                  DA   3700
      DO 10 I=1,NSET                                                    DA   3800
      READ(5,901) L,(LPCOMP(I,J),PERMB(I,J),J=1,L)                      DA   3900
   10 LICOMP(I)=L                                                       DA   4000
      READ(5,902) NATRIM,NADRFT,NAWEEL                                  DA   4100
      IF(NATRIM)20,30,20                                                DA   4200
   30 NATRIM=1                                                          DA   4300
      DITRIM(1)=0.                                                      DA   4400
      GO TO 40                                                          DA   4500
   20 DO 25 I=1,NATRIM                                                  DA   4600
   25 READ(5,903) DITRIM(I+1)                                           DA   4700
      DITRIM(1) = 0.                                                    DA   4800
   40 READ(5,903) (DTDRFT(I),I=1,NADRFT)                                DA   4900
      READ(5,903) (DTWEEL(I),I=1,NAWEEL)                                DA   5000
 9000 FORMAT(I5)                                                        DA   5100
  901 FORMAT(I4/(10(I4,F4.2)))                                          DA   5200
  902 FORMAT(3I5)                                                       DA   5300
  903 FORMAT(F10.2)                                                     DA   5400
  904 FORMAT(' NUMBER OF COMPARTMENT SETS=' I5//)                       DA   5500
  905 FORMAT(' COMPARTMENTS IN SET',I3,4X,'COMPARTMENT NUMBER',(PERMEABILITDA  5600
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     1Y)*/(10(19*(*F8.4*1*)))                                                  DA  5600
906  FORMAT(//* NUMBER OF INPUT DRAFTS=*I3/)                                   DA  5700
907  FORMAT(* INPUT DRAFTS = * 10F10.2)                                        DA  5800
908  FORMAT(//* NUMBER OF INPUT HEEL ANGLES=*I3/)                              DA  5900
909  FORMAT(* INPUT HEEL ANGLES = * 10F8.2)                                    DA  6000
910  FORMAT(//* NUMBER OF INPUT TRIMS =*I3/)                                   DA  6100
911  FORMAT(* INPUT TRIMS IN DEGREES=* 10I8)                                   DA  6200
     WRITE(6,906) NAME,ISERNO,DATE                                             DA  6300
     WRITE(6,913)                                                              DA  6400
     WRITE(6,904) NSET                                                         DA  6500
     DO 80 I= 1,NSET                                                           DA  6600
     L=L1COMP(I)                                                               DA  6700
 90  WRITE(6,905) I,(L2COMP(I,J),PERMA(I,J),J=1,L)                             DA  6800
     WRITE(6,906) NODRFT                                                       DA  6900
     WRITE(6,907) DIDRFT                                                       DA  7000
     WRITE(6,908) NOHEEL                                                       DA  7100
     WRITE(6,909) DIHEEL                                                       DA  7200
     WRITE(6,910) NOTRIM                                                       DA  7300
     WRITE(6,911) DITRIM                                                       DA  7400
912  FORMAT(* DEFINITIONS OF DAMAGE STABILITY OUTPUT*/*COMPARTMENT PROPDA  7500
    1ERTIES*/*  VOLUMES IN CU. FT., CORRECTED FOR PERMEABILITY*/*  LCBSDA  7600
    2 IN FT FROM MIDSHIPS*/*  SHIP DISPLACEMENT IN TONS*/*  HEELING ANDA  7700
    3M IN DEGS*)                                                               DA  7800
913  FORMAT(* DAMAGE STABILITY INPUT DATA*)                                    DA  7900
804  FORMAT(6H1SHIP-8A4,5X,14HSERIAL NUMBER-I8,5HDATE-2A4/)                    DA  8000
     KVOL=1                                                                    DA  8100
     KK = 1                                                                    DA  8150
     ITEST1=2                                                                  DA  8200
     KW=1                                                                      DA  8300
     JSERNO = ISERNO                                                           DA  8400
     DO 900 I=1,NSET                                                           DA  8500
     DO 900 ITRIM=1,NOTRIM                                                     DA  8600
     THET1= DITRIM(ITRIM)*.01745329                                            DA  8700
     DO 900 IDRFT=1,NODRFT                                                     DA  8800
     HIBASC= DIDRFT(IDRFT)                                                     DA  8900
     DO 900 I3=1,NOHEEL                                                        DA  9000
     THET1H=DIHEEL(I3)*.01745329                                               DA  9100
     ISERNO =JSERNO                                                            DA  9200
     CALL OFFSET                                                               DA  9300
     DO 807 INAME = 1,8                                                        DA  9310
807  NAME2S(INAME)= NAME  (INAME)                                              DA  9320
     CALL VOLUME                                                               DA  9400
     VISHIP= VOL                                                               DA  9500
     TCBISH= TCB                                                               DA  9600
     XLCBSH= XLCB                                                              DA  9700
     VCBISH= XKB                                                               DA  9800
     L=L1COMP(I)                                                               DA  9900
     DO 90 I4=1,L                                                              DA 10000
     ISERNO= L2COMP(I,I4)                                                      DA 10100
     ITEST1 = 2                                                                DA 10200
     CALL OFFSET                                                               DA 10300
     IF(ITEST1 .EQ. 987)   GO TO 9999                                          DA 10301
     CALL VOLUME                                                               DA 10400
     VOLIC(I4) = VOL*PERMB(I,I4)                                               DA 10500
     TCBIC(I4)=TCB                                                             DA 10600
     XLCBIC(I4)=XLCB                                                           DA 10700
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      90 VCR1C(I4)=XMB                                                    DA 10800
    9[4 FORMAT(* TRIM=*I8* DEG.  DRAFT=*F8.2* FT.  HEEL=*F8.2* DEGREES*//)DA 10900
    9[6 FORMAT(* COMPARTMENT PROPERTIES OF FLOODED WATER*/* COMP. NO.    VDA 11000
     1OLUME       LCB     VCB     TCB*/)                                 DA 11100
    9[8 FORMAT(3X[8,2XF10.0,2XF7.2,1XF6.2,1X,F6.2)                       DA 11200
        WRITE(6,906) NAMESB,JOBNNO,DATE                                  DA 11300
        WRITE(6,914) DITRIM(ITRIM),DIDRFT(IDRFT),DIHEEL(IH)              DA 11400
        WRITE(6,918)                                                     DA 11500
        VOL1T=0.                                                         DA 11600
        TCB1T=0.                                                         DA 11700
        VCB1T=0.                                                         DA 11800
        XLCB1T=0.                                                        DA 11900
        DO 80 I=1,L                                                      DA 12000
        WRITE(6,916) LBCOMP(I,IH),VOL1C(I4),XLCB1C(I4),VCR1C(I4),TCB1C(I4)DA 12100
        TCB1T= (TCB1T*VOL1T+TCB1C(I4)*VOL1C(I4))/(VOL1T+VOL1C(I4))       DA 12200
        VCB1T= (VCB1T*VOL1T+VCB1C(I4)*VOL1C(I4))/(VOL1T+VOL1C(I4))       DA 12300
        XLCB1T=(XLCB1T*VOL1T+XLCB1C(I4)*VOL1C(I4))/(VOL1T+VOL1C(I4))     DA 12400
     80 VOL1T=VOL1T+VOL1C(I4)                                            DA 12500
        WRITE(6,917) TITLE(1),TITLE(2),TITLE(3),VOL1T,XLCB1T,VCB1T,TCB1T DA 12600
        WRITE(6,917) TITLE(4),TITLE(5),TITLE(6),VISHIP,XLCBSH,VCB1SH,TCB1SDA 12700
     1H                                                                  DA 12800
    917 FORMAT(/1XA6,A2/1XA6,3XF10.0,F9.2,2F7.2)                         DA 12900
        TCB1T=(VISHIP*TCB1SH-VOL1T*TCB1T)/(VISHIP-VOL1T)                 DA 13000
        VCB1T=(VISHIP*VCB1SH-VOL1T*VCB1T)/(VISHIP-VOL1T)                 DA 13100
        XLCB1T=(VISHIP*XLCBSH-VOL1T*XLCB1T)/(VISHIP-VOL1T)               DA 13200
        VOL1T=VISHIP-VOL1T                                               DA 13300
        DSPL=VOL1T/35.                                                   DA 13400
        WRITE(6,917) TITLE(1),TITLE(2),TITLE(6),VOL1T,XLCB1T,VCB1T,TCB1T DA 13500
        WRITE(6,918) DSPL                                                DA 13600
    918 FORMAT(/* DISPLACEMENT OF DAMAGED SHIP IN TONS=* F10.2)          DA 13700
        RGTARM= TCB1T/COS(THET1H)+ VCB1T*SIN(THET1H)-TCB1T*SIN(THET1H)**2/DA 13800
     1COS(THET1H)                                                        DA 13900
        WRITE(6,919)RGTARM                                               DA 14000
    919 FORMAT(/* RIGHTING ARM IN FEET=*F8.2)                            DA 14100
    900 CONTINUE                                                         DA 14200
   9999 RETURN                                                           DA 14300
        END                                                              DA 14400
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      SUBROUTINE DERIVE                                                 DE   200
      DIMENSION  A(30),Y2(30)                                           DE   300
      DIMENSION DELX(30), DELA2(30)                                     DE   400
      DIMENSIONAIWP3(20),AMEAIS(40,20),AMEAPS(40),AMEAAS(20,10),RM.(20),DI   500
     1RMT(20),CIALPH(20),CIP(40),CIWP(20),CIDOPT(20),DATE(2),DISPLJ(20),DI   600
     1GWL(20),M(60),MICOMP(20),MIMON(60),MIMAR(40),MIOUT(20),MIBAD(40),MDI   700
     1ICOMP(20),ICOMB(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   800
     1AMEIS(8),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   900
      DIMENSIONPERM2(10),MAB(5,5,10),S(60,20),SPS(60),SIGMIP(20),STATNO(DI  1000
     160),SECTIM(20),TCMIC(20),TCMB(5,5,10),TCOIS(40,20),TCOPS(60),THETSDI  1100
     1M(10),TPI(20),TRIMJ(6),VCRIC(20),VCRB(5,5,10),VCOIS(40,20),VCOPS(6DI  1200
     10),VOLT(20),VOLS(9),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAM2(10DI  1300
     1),XIDAM3(20),XDDAM3(20),XIW(20),XPDAM(30),XPDAM3(10)              DI  1400
      DIMENSIONXPS(60),XMB3(20),XMML(20),XMMT(20),XLIDAM(30,3),XLCMIC(20DI  1500
     1),XLCM3(20),XLCP3(20),XLCOIW(20),XLCOS(5),XMTI(20),Y(60,20),Y1(60)DI  1600
     1,Y2(60,20),YINT(6,30),THETJM(6)                                   DI  1700
      DIMENSION ALVM(20)                                                DI  1800
      COMMON/1/AIMA,AIWP,AIWPJ,AMEAIS,AMEAPS,AMEAAS,RML,RMT,CIA,CIALPH,CDI  1900
     1IM,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPLJ,GWL,M,MIMARC,MICOMPDI  2000
     1,MCOMP,MIMON,MIMAR,MIOUT,MIBAD,MZMAR,MJMAR,MOMAR,NWL,IIAPT,IIBAL,DI  2100
     1IIPWD,IISYM,IIWC,IIWM,IIWL,I2WC,I2WM,I2WL,INREAR,ICOMP,ICHECK,INITDI  2200
     1,ISENTL,ISERNO,ISTAT,ISTOP,IT2ST1,IT2ST2,IY,JREAR                 DI  2300
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIMERL,NILCODI  2400
     1,NIPERM,NITRIM,NAME,NAMEIS,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2500
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,MAB,S,SIGMIP,SPS,SIGMIDI  2600
     1P,SPACE,STATNO,SLCTIM,TCB,TCMIC,TCMB,TCOIS,TCOPS,THETIM,THETIT,THEDI  2700
     1TAT,THETBM,TPI,TRIMJ,VCMIC,VCRB,VCOIS,VCOPS,VOL                   DI  2800
      COMMON/3/VOLIC,VOLID,VOLS,WAVCEN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2900
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPS,XSLIM,XDI  3000
     1ALIM,XILIM,XIIT,XMB,XMB3,XMML,XMMT,XLIDAM,XLMP,XLCR,XLCRIC,XLCRJ,XLDI  3100
     1CP,XLCP3,XLCO,XLCOIW,XLCOS,XLMBIM,XLMBDA,XMID,XMOMIL,XMOMJV,XMTI,YDI  3200
     1,Y1,Y1MA,Z,WAVLOC ,XIDAM6,X2DAM6,XLMBPR,IAMAL                     DI  3300
      COMMON/4/ICAT,YIINT,NJHELL,THETJM,LIMIT                           DI  3400
      READ(5,22) CHDWL,RIMLD,MIDWL,DIMLD,XLCWL,CXDWL,PHI                DE   100
   22 FORMAT(7F10.2)                                                    DE   200
      DCY=0.0                                                           DE   300
      DCX=0.0                                                           DE   400
      ISTAT=MA                                                          DE   500
      M(ISTAT)=MIBASC                                                   DE   600
    4 CXI=AMEAPS(ISTAT)/(Y1MA**2.0*MIBASC)                             DE   700
      IF (ABS(CXDWL-CXI)-0.0001) 7,7,8                                  DE   800
    8 DCX=CXDWL-CXI                                                     DE   900
      DCY=DCY+DCX                                                       DE  1000
      NPOINT=NP(ISTAT)                                                  DE  1100
      DO 6 IPOINT=1,NPOINT                                              DE  1200
      Y(ISTAT,IPOINT)=Y(ISTAT,IPOINT)+DCX*Y1MA*(1.0-(ABS(Y(ISTAT,IPOINT)DE  1300
     1-Y1MA/2.0)/(Y1MA/2.0)))**2.0                                      DE  1400
    6 CONTINUE                                                          DE  1500
      CALL TABLE                                                        DE  1600
      ISTAT=MA                                                          DE  1700
      M(ISTAT)=MIBASC                                                   DE  1800
      CALL AREAS                                                        DE  1900
      GO TO 4                                                           DE  2000
    7 IAPT=IIAPT-1                                                      DE  2100
      DO 10 ISTAT=IIPWD,IAPT                                            DE  2200
      IF (ISTAT-MA) 9,9,9                                               DE  2300
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      8 JSTAT=ISTAT                                                      DE  2900
        GO TO 10                                                         DE  3000
      9 JSTAT=ISTAT+1                                                    DE  3100
     10 NPOINT=NP(JSTAT)                                                 DE  3200
        DIST=1.0-(ABS(X(ISTAT)-X(MA))/XLHP**2.0)                         DE  3300
        DO 12 IPOINT=1,NPOINT                                            DE  3400
     12 Y(JSTAT,IPOINT)=Y(JSTAT,IPOINT)*DCY*Y(MA)*DIST**(1.0-(ABS(Y(JSTAT,IPDE  3500
       1OINT)-Y(MA/2.0))/(Y(MA/2.0)))**2.0                               DE  3600
     14 CONTINUE                                                         DE  3700
        CALL TABLE                                                       DE  3800
        ISTAT=MA                                                         DE  3900
        CALL AREAS                                                       DE  4000
        AMA=AREAS(ISTAT)                                                 DE  4100
        KVOL=1                                                           DE  4200
        CALL VOLUME                                                      DE  4300
        RUN=X(IAFT)-X(MA)                                                DE  4400
        ENT=X(MA)                                                        DE  4500
C       LCB FROM STATION OF MAXIMUM AREA (POSITIVE FORWARD)              DE  4600
        XLCB=X(MA)-XMID*XLCB                                             DE  4700
C       NORMALISE LCB IN TERMS OF ENTRANCE AND RUN LENGTHS               DE  4800
        ZNAR=XLCB/ENT                                                    DE  4900
        ZNAR2=(-XLCB)/RUN                                                DE  5000
C       PRISMATIC OF PARENT                                              DE  5100
        PHI=VOL/(AREAS(MA)*XLHP)                                         DE  5200
C       REQUIRED CHANGE IN PHISMATIC                                     DE  5300
        DPHI=CPDWL-PHI                                                   DE  5400
C       CONSIDER ENTRANCE AND RUN AS TWO DAMAGED COMPARTMENTS WITH PERM=1DE  5500
        KVOL=4                                                           DE  5600
        NCOMP=2                                                          DE  5700
        XIDAM(1)=X(IFWD)                                                 DE  5800
        XIDAM(2)=X(MA)                                                   DE  5900
        XSDAM(1)=X(MA)                                                   DE  6000
        XSDAM(2)=X(IAFT)                                                 DE  6100
        PERM(1)=1.0                                                      DE  6200
        PERM(2)=1.0                                                      DE  6300
        CALL VOLUME                                                      DE  6400
C       NORMALIZE LCB'S OF ENTRANCE AND RUN IN TERMS OF RESPECTIVE LENGTHSDE  6500
C       BOTH THE VALUES ARE POSITIVE                                     DE  6600
        FXNAR=(X(MA)-XMID+XLCB(1))/ENT                                   DE  6700
        AXNAR=(XMID-XLCB(2)-X(MA))/RUN                                   DE  6800
C       FIND PRISMATIC COEFFICIENTS OF ENTRANCE AND RUN                  DE  6900
        FPHI=VOL(1)/(AMA*ENT)                                            DE  7000
        APHI=VOL(2)/(AMA*RUN)                                            DE  7100
C       NORMALISE RADII OF GYRATION OF ENTRANCE AND RUN                  DE  7200
        FK=(ENT-XLVR(1))/ENT                                             DE  7300
        AK=(XLVR(2)-RUN)/RUN                                             DE  7400
C       NORMALISE STATION DISTANCES FROM STATION OF MAX AREA             DE  7500
        DO 30 ISTAT=1,MA                                                 DE  7600
     30 XSS(ISTAT)=(ENT-X(ISTAT))/ENT                                    DE  7700
        DO 40 ISTAT=MA,NSTAT                                             DE  7800
     40 XSS(ISTAT)=(X(ISTAT)-ENT)/RUN                                    DE  7900
        XSS(IIFWD)=1.0                                                   DE  8000
        XSS(IIAFT)=1.0                                                   DE  8100
        XSS(MA)=0.0                                                      DE  8200
C       CHECK IF REQUIRED CP IS CLOSE ENOUGH TO THAT OF PARENT           DE  8300
        IF(ABS(DPHI)-0.0001)42,42,50                                     DE  8400
```

```
                                                                                                                    DE   8500
      42 DO 44 ISTAT=IIFWD,IIAFT                                                                                    DE   8600
      44 DELX(ISTAT)=0.0                                                                                            DE   8700
         GO TO 99                                                                                                   DE   8800
      60 CALL DRVE(ZBARF,ZBARB,FPHI,APHI,FK,AK,DELX,DELXB,PHI,CPHI,IIAFT,                                           DE   8900
        1IIFWD,FXBAR,AXBAR)                                                                                         DE   9000
C        SHIFT STATIONS                                                                                           DE   9100
      99 DO 80 ISTAT=IIFWD,IIAFT                                                                                    DE   9200
      80 XB(ISTAT)=XB(ISTAT)+DELX(ISTAT)                                                                            DE   9300
         DO 100 ISTAT=IIFWD,IIAFT                                                                                   DE   9400
         IF(ISTAT-MA)70,80,80                                                                                       DE   9500
      70 AFTPT=0.0                                                                                                  DE   9600
         FORPT=(-1.0)                                                                                               DE   9700
         GO TO 90                                                                                                   DE   9800
      80 AFTPT=1.0                                                                                                  DE   9900
         FORPT=0.0                                                                                                  DE  10000
      90 X(ISTAT) = (ENT+XB(ISTAT)+(AFTPT+RUN+FORPT+ENT))+XLDWL/XLBP                                                DE  10100
         NPOINT=NP(ISTAT)                                                                                           DE  10200
         YRATIO = WIMLD/(YIMA*2.0)                                                                                  DE  10300
         ZRATIO=HIDWL/HBASC                                                                                         DE  10400
         DO 100 IPOINT=1,NPOINT                                                                                     DE  10500
         Y(ISTAT,IPOINT)=Y(ISTAT,IPOINT)*YRATIO                                                                     DE  10600
         Z(ISTAT,IPOINT)=Z(ISTAT,IPOINT)*ZRATIO                                                                     DE  10700
     100 CONTINUE                                                                                                   DE  10800
         CALL TABLE                                                                                                 DE  10900
         ISTAT = MA                                                                                                 DE  11000
         H(ISTAT) = HIDWL                                                                                           DE  11100
         CALL AREAS                                                                                                 DE  11200
         AIMA = AREAS(ISTAT)                                                                                        DE  11300
         YIMA = WIMLD/2.0                                                                                           DE  11400
         XLBP = XLDWL                                                                                               DE  11500
         XMID = XLBP/2.0                                                                                            DE  11600
         RETURN                                                                                                     DE  11601
         HIBASC = HIDWL                                                                                             DE  11602
         ITEST1 = 3                                                                                                 DE  11603
         INIT = 0                                                                                                   DE  11604
         CALL OFFSET                                                                                                DE  11605
         ITEST1 = 2                                                                                                 DE  11700
         END
```

**** FORTRAN SOURCE CODE ERRORS ****

01016 TYPE ERROR IN STATEMENT NUMBER 100 PLUS 10
THERE IS NO PATH TO THIS STATEMENT

```
   40 DO 44 ISTAT=I1FWD,I1AFT                                                    DE  8800
   44 DELX(ISTAT)=0.0                                                            DE  8900
      GO TO 99                                                                   DE  8700
   50 CALL DRVE(ZBARF,ZBARB,PPHI,APHI,PK,AK,DELX,DELXB,PHI,DPHI,I1AFT,           DE  8800
     1I1FWD,PXBAR,AXBAR)                                                        DE  8900
C     SHIFT STATIONS                                                           DE  9000
   99 DO 60 ISTAT=I1FWD,I1AFT                                                   DE  9100
   60 XBS(ISTAT)=XBS(ISTAT)+DELX(ISTAT)                                         DE  9200
      DO 100 ISTAT=I1FWD,I1AFT                                                  DE  9300
      IF(ISTAT-MA)70,80,80                                                      DE  9400
   70 APTPT=0.0                                                                 DE  9500
      FORPT=(-1.0)                                                              DE  9600
      GO TO 90                                                                  DE  9700
   80 APTPT=1.0                                                                 DE  9800
      FORPT=0.0                                                                 DE  9900
   90 X(ISTAT) = (ENT+XBS(ISTAT)*(APTPT+RUN+FORPT*ENT))*XLOWL/XLAP              DE 10000
      NPOINT=NP(ISTAT)                                                          DE 10100
      YRATIO = BIMLD/(YIMA*2.0)                                                 DE 10200
      ZRATIO=HIDWL/HIBASC                                                       DE 10300
      DO 100 IPOINT=1,NPOINT                                                    DE 10400
      Y(ISTAT,IPOINT)=Y(ISTAT,IPOINT)*YRATIO                                    DE 10500
      Z(ISTAT,IPOINT)=Z(ISTAT,IPOINT)*ZRATIO                                    DE 10600
  100 CONTINUE                                                                  DE 10700
      CALL TABLE                                                                DE 10800
      ISTAT = MA                                                                DE 10900
      H(ISTAT) = HIDWL                                                          DE 11000
      CALL AREAS                                                                DE 11100
      AIMA = AREABS(ISTAT)                                                      DE 11200
      YIMA = BIMLD/2.0                                                          DE 11300
      XLAP = XLOWL                                                              DE 11400
      XMID = XLAP/2.0                                                           DE 11500
      RETURN                                                                    DE 11600
      HIBASC = HIDWL                                                            DE 11601
      ITEST = 3                                                                 DE 11602
      INIT = 0                                                                  DE 11603
      CALL OFFSET                                                               DE 11604
      ITEST = 2                                                                 DE 11605
      END                                                                       DE 11700
```

**** FORTRAN SOURCE CODE ERRORS ****

C1016 TYPE ERROR IN STATEMENT NUMBER 100 PLUS 10
THERE IS NO PATH TO THIS STATEMENT

```
      SUBROUTINE DRVB(ZBAR1,ZBARB,FPHI,APHI,FR,AK,DELA,DELAB,PHI,DPHI,   DR   200
     1NAFT,NFOR,FXBAR,AXBAR)                                             DR   300
      DIMENSION DELA(30), DELAB(30)                                      DR   400
      DIMENSIONALWP3(20),AREA1B(60,20),AREABB(60),AREA6B(20,30),BML(20),DI   500
     1BMT(20),C1ALPH(20),C1P(20),C1WP(20),C1DOFT(20),DATE(2),DISPL3(20),DI   600
     1DWL(20),H(60),HICOMP(20),HIHOG(60),HIMAH(60),HIOUT(20),HISAG(60),HDI   700
     1XCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(6),NAME(6),NDI   800
     1AME1B(6),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                    DI   900
      DIMENSIONPERM2(10),NAB(5,5,10),B(60,20),BPB(60),BPBHIP(20),STATNO(DI  1000
     160),SECTIN(20),TCB1C(20),TCBB(5,5,10),TCB1B(60,20),TCB2B(60),THETSDI  1100
     1H(10),TPI(20),THIM3(6),VCB1C(20),VCBB(5,5,10),VCB1B(60,20),VCB2B(6DI  1200
     10),VOL3(20),VOL6(6),VOL1C(20),WEIGHT(20),X(60),XIDAM(30),XIDAM2(10DI  1300
     1),XIDAM6(20),XPDAM6(20),XIW(20),XPDAM(30),XRDAME(10)               DI  1400
      DIMENSIONXBB(60),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCB1C(20DI  1500
     1),XLCB3(20),XLCF3(20),XLCG1W(20),XLCG6(5),XMTI(20),Y(60,20),Y1(60)DI  1600
     1,Z(60,20),YIINT(4,10),THETJM(9)                                    DI  1700
      DIMENSION XLVM(20)                                                 DI  1800
      COMMON/1/AIMA,AIWP,AIWP3,AREA1B,AREABB,AREA6B,BML,BMT,C1A,C1ALPH,CDI  1900
     1BB,C1C,C1P,C1DOFT,C1WP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  2000
     1,HICOMP,HIHOG,HIMAH,HIOUT,HISAG,HXMAH,H3MAH,H6MAH,HW1,IIAFT,IIMAL,DI  2100
     1IIFWD,IISYM,IIWC,IIWH,IIWL,ISWC,ISWH,ISWL,JBREAK,ICOMP,ICHECK,INITDI  2200
     1,ISENTL,ISEPNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                 DI  2300
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHEEL,NILCGDI  2400
     1,NIPERM,NITRIM,NAME,NAME1B,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2500
     1TAT2,NSTAT3,NSTAT6,NWL,NWP,PERM,PERM1,PERM2,NAB,B,BIBHIP,BPB,BXBHIDI  2600
     1P,BPACE,STATNO,SECTIN,TCB,TCB1C,TCBB,TCB1B,TCB2B,THETIN,THETIT,THEDI  2700
     1TBT,THETBH,TPI,THIM3,VCB1C,VCBB,VCB1B,VCB2B,VOL                    DI  2800
      COMMON/3/VOL1C,VOL1D,VOL3,VOL6,WAVCEN,WC1INC,WEIGHT,WH1INC,WH1MUL,DI  2900
     1WL1INC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPB,XJLIM,XDI  3000
     14LIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCB1C,XLCB3,XLDI  3100
     1CF,XLCF3,XLCG,XLCG1W,XLCG6,XLMB1R,XLMBPA,XMID,XMOMIL,XMOMJV,XMTI,YDI  3200
     1,Y1,YIMA,Z,WAVLOC ,XIDAM6,XPDAM6,XLMBPR,IABAL                      DI  3300
      COMMON/4/ICAT,YIINT,NJWEEL,THETJM,LIMIT                            DI  3400
      ERR1 = 1                                                           DR   400
C     ERR1 IS AN ERROR INDICATOR  FOR THE CHANGE IN THE  FOR AND AFT     DR   500
C     PRISMATIC  CHANGE. IF ERR1 = 2  THEN  PRISMATIC CHANGE IS  OUT     DR   600
C     OF BOUNDS.                                                         DR   700
C           SET VARIABLES FOR LCB  CHANGE(DELTA LCB ) AND  PARALLEL      DR   800
C           MIDDLE BODY EQUAL TO ZERO                                    DR   900
      PMBFR =0.0                                                         DR  1000
      PMBA  =0.0                                                         DR  1100
      DELPR =0.0                                                         DR  1200
      DELPA =0.0                                                         DR  1300
      DZBM1 = 0.0                                                        DR  1400
      DZBM2 = 0.0                                                        DR  1500
C               ZERO OUT DELA AND  DELAB  ARRAYS                         DR  1600
      DO 2  I = 1,30                                                     DR  1700
      DELA(I) = 0.0                                                      DR  1800
    2 DELAB(I)= 0.0                                                      DR  1900
C           SET  CONSTANTS  DEPENDING ONLY  ON THE GEOMETRICAL           DR  2000
C           PROPERTIES OF THE BASIS FORM .                               DR  2100
      FZMXB =  1.0  - 2.0* FXBAR                                         DR  2200
      AZMXB =  1.0  - 2.0* AXBAR                                         DR  2300
      AF = FPHI *( FZMXB )  - PMBFR *(1.0 - FPHI)                        DR  2400
      AA = APHI*(AZMXB )  -  PMBA *(1.0 - APHI)                          DR  2500
      BF =  FPHI * (2.0*FXBAR - 3.0*(FX**2) - PMBFR *FZMXB ) / AF        DR  2600
```

```
      BA =  APHI * (2.0*AMMAH - 2.0*(AK**2) - PMBA  *AZMXR ) / AA          DR  2900
      CF =  (RF * (1.0 - FPHI) - FPHI * FYMXR  ) / (1.0 - PMBFR )         DR  3000
      CA =  (RA * (1.0 - APHI) - APHI * AZMXR  ) / (1.0 - PMBA  )         DR  3100
C           SET TEST LIMITS FOR CHANGE IN PRISMATIC , FOR AND AFT         DR  3200
C           SECTIONS                                                      DR  3300
      FDPIP =  DELPH  / (1.0 - PMBFR)                                     DR  3400
      ADPIP =  DELPA  / (1.0 - PMBA )                                     DR  3500
      PIFT  =(DELPR * (1.0- FPHI )  +0.5 *AF * (1.0 - FDPIP)  )/ (1.0 -   DR  3600
     1PMBFR)                                                              DR  3700
      PPFT  =(DELPR * (1.0- FPHI )  -0.5 *AF * (1.0 - FDPIP)  )/ (1.0 -   DR  3800
     1 PMBFR)                                                             DR  3900
      PIAFT =( DELPA * (1.0 -APHI)  + .5 *AA * (1.0 - ADPIP)  )/(1.0-     DR  4000
     1 PMBA )                                                             DR  4100
      PPAFT =( DELPA * (1.0 -APHI)  - .5*AA * (1.0 - ADPIP)  )/(1.0 -     DR  4200
     1 PMBA )                                                             DR  4300
C     PREPARE TO CALC. CHANGE IN FOR AND AFT PRISMATICS                   DR  4400
      ZPH =  PHI  * DPHI                                                  DR  4500
      CFDP =   CF  * DELPR                                                DR  4600
      CADP = CA * DELPA                                                   DR  4700
      BSM  =  BF  * BA                                                    DR  4800
C           CALC. CHANGES IN PRISMATICN                                   DR  4900
      DPHFR = (8.0 * (DPHI *(BA* ZBARI) + DZRMI* ZPH ) + CFDP - CADP )    DR  5000
     1  / BSM                                                             DR  5100
      DPHA  = (2.0 * (DPHI *(BF -ZBARF) - DZRMB6 ZPH ) - CFDP + CADP )    DR  5200
     1 / BSM                                                              DR  5300
      OMP1 = 1.0 -FPHI                                                    DR  5400
      OMP2 = 1.0 - APHI                                                   DR  5500
      QB1 = AF*(1.0 - FDPIP) * DPHFR* (1.0 + PMBFR) - FDPIP * OMP1    -   DR  5600
     1 PMBFR *  FDPIP * OMP1                                              DR  5700
      QB2 = AA *(1.0 - ADPIP) * DPHA  *(1.0 + PMBA) - ADPIP *OMP2    -    DR  5800
     2 PMBA * ADPIP * OMP2                                                DR  5900
      QA1  = (FDPIP * (OMP1) ) -  DPHFR                                   DR  6000
      QA2  = (ADPIP * OMP2 )  - DPHA                                      DR  6100
C        CHECK IF PRISMATIC  CHANGES ARE IN  RANGE                        DR  6200
      IF (DPHFR)80,200,60                                                 DR  6300
   80 IF ( PPFT - DPHFR)200,200,150                                       DR  6400
   60 IF ( PIFT - DPHFR) 150,200,200                                      DR  6500
  150 ERR1 = 2                                                            DR  6600
      GO TO 2000                                                          DR  6700
  200 IF (DPHA)250,300,200                                                DR  6800
  250 IF ( PPAFT -DPHA ) 300,300,150                                      DR  6900
  260 IF ( PIAFT - DPHA ) 150,300,300                                     DR  7000
  300  CONTINUE                                                           DR  7100
C           CHANGE  FOREBODY SECTION                                      DR  7200
      DO  320  IK = NFOR,MA                                               DR  7300
      QC1 =  AF *(FDPIP -XBB(IK))*(PMBFR*(DPHFR)+(PMBFR *FDPIP) *OMP1)    DR  7400
      XT  =  ( - QB1  + SQRT ( QB1**2 - 4.0* QA1* QC1 ) ) /(2.0*QA1  )    DR  7500
  317  IF(XT) 321,318,323                                                 DR  7600
  321    IF (XT +  .00006   ) 322,320,320                                DR  7700
  320    XT = 0.00                                                        DR  7800
         GO TO  322                                                       DR  7900
  318    WRITE(3,319) XBB(IK) , XT                                        DR  8000
  319  FORMAT(5X,*FOREBODY  STATION = *,F8.3,2X,*DELXB=*,F8.3,*IS OUT     DR  8100
     1OF RANGE *)                                                         DR  8200
  323  IF( XT - 1.0) 322,322,325                                          DR  8300
  322  IF ( ABS(XT -1.0) - 0.00006 ) 326,326,324                          DR  8400
```

```
      XT = 1.000                                                                DR  8500
      GO TO  332                                                                DR  8600
  324 XT =  ( - QB) - SQRT( QB)**2  - 4.0*QA)*QC) ) / (2.0*QA))                 DR  8700
      IF (XT - 1.0 ) 327,332,341                                                DR  8800
  341     WRITE(3,342) XBS(IK) , XT                                             DR  8900
  342 DELXB (IK) = XT                                                           DR  9000
  326 DELX(IK) = (1.0 - XBS(IK) ) *( FDP)P +(( XBS(IK) - PMBPH) /AP )           DR  9100
     1  * ( DPMPR  =  ( FDP)P * (1.0 - PPHI )) ) )                             DR  9200
C           CHANGE  APT BODY SECTION                                            DR  9300
      MA) = MA +1                                                               DR  9400
      DO 330 IK = MA),NAPT                                                      DR  9500
      QC2 =  AA *(ADP)P -XBS(IK))-(PMBA *DPHA ).(PMBA * ADP)P) * OMPS           DR  9600
      XT = ( - QB2  ,SQRT(QB2**2 - 4.0*QA2*QC2 ) ) / (2.0*QA2)                  DR  9700
  330 IF( XT) 331,335,333                                                       DR  9800
  331  IF (XT + 0.00000  )332,330,330                                          DR  9900
  330     XT = 0.000                                                            DR 10000
      GO TO 332                                                                 DR 10100
  334   WRITE(3,381) XBS(IK) ,XT                                                DR 10200
  381  FORMAT(5X,*APT BODY  STATION = *,F8.3,5X,*DELXB**,F8.3,*IS OUT           DR 10300
     1OF RANGE *)                                                               DR 10400
  333  IF (XT - 1.0) 332,332,336                                                DR 10500
  335  IF ( ABS(XT -1.0) - 0.00000 ) 336,336,334                                DR 10600
  334   XT = 1.000                                                              DR 10700
      GO TO 332                                                                 DR 10800
  336  XT =  ( - QB2  - SQRT( QB2**2 - 4.000A2*QC2 )) /(2.0*QA2 )               DR 10900
      IF( XT -1.0 ) 330,332,370                                                 DR 11000
  370   WRITE(3,381) XBS(IK) ,XT                                                DR 11100
  332 DELXB(IK) = XT                                                            DR 11200
  330 DELX(IK)  = (1.0 -XBS(IK))*  (ADP)P * (( ( XBS(IK) - PMBA) / AA )        DR 11300
     1 *  ( DPHA  =  ( ADP)P * (1.0 - APHI ) )) ))                             DR 11400
 8000  RETURN                                                                   DR 11500
      END                                                                       DR 11600
```

```
      SUBROUTINE DRAFT                                                  DR   200
      DIMENSIONALWP3(20),AREA1B(60,20),AREA2B(60),AREA4B(20,30),BML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL3(20),DI   400
     1DWL(20),H(60),HICOMP(20),HIHOO(60),HIMAR(60),HIOUT(20),HIBAO(60),HDI   500
     1ZCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   600
     1AME1B(8),NCOMP2(2,3,3),NP(60),PERMH(10),PERMI(3)                  DI   700
      DIMENSIONPERMP(10),RAB(8,8,10),S(60,20),SPB(60),S2BHIP(20),STATNO(DI   800
     160),SECTIM(20),TCB1C(20),TCBB(8,8,10),TCB1B(60,20),TCOPB(60),THETSDI   900
     1M(10),TPI(20),TRIMJ(6),VCB1C(20),VCBB(8,8,10),VCB1B(60,20),VCOPB(6DI  1000
     10),VOL3(20),VOL8(8),VOL1C(20),WEIGHT(20),X(60),XIDAM(30),XIDAMB(180DI  1100
     1),XIDAM8(20),XPDAM8(20),XIW(20),XPDAM(30),XPDAMW(10)              DI  1200
      DIMENSIONAB(90),XKW3(20),XKML(20),XKMT(20),XL1DAM(30,3),XLCB1C(20DI  1300
     1),XLCB3(20),XLCP3(20),XLCB1W(20),XLCBB(8),XMTI(20),Y(60,20),YI(60)DI  1400
     1,Z(60,20),YIINT(6,30),THETJM(8)                                   DI  1500
      DIMENSION XLYM(20)                                                DI  1600
      COMMON/1/AIMA,AIWP,AIWP3,AREA1B,AREA2B,AREA4B,BML,BMT,CIA,CIALPH,CDI  1700
     11B,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  1800
     1,HPCOMP,HIHOO,HIMAR,HIOUT,HIBAO,HPMAR,H3MAR,H4MAR,HWI,IIAFT,IIBAL,DI  1900
     1IIFWD,IISYM,IIWC,IIWM,IIWL,IPWC,IPWM,IPWL,IBREAK,ICOMP,ICHERK,INITDI  2000
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIOUT,NIOSPL,NIWEEL,NILCODI  2200
     1,NIPERM,NITRIM,NAME,NAME1B,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,S1BHIP,SPB,S2BHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCB,TCB1C,TCBB,VCB1B,TCOPB,THETIM,THETIT,THEDI  2500
     1TAT,THETBM,TPI,TRIMJ,VCB1C,VCBB,VCB1B,VCOPB,VOL                   DI  2600
      COMMON/3/VOL1C,VOL1B,VOL3,VOL8,WAVCEN,WC1INC,WEIGHT,WM1INC,WM1KWL,DI  2700
     1WL1INC,X,XIDAM,XIDAMB,XILIM,XIM,XIW,XPDAM,XPDAMB,XPLIM,XPB,XJLIM,XDI  2800
     1KLIM,XIIL,XIIT,XKW3,XKW3J,XKML,XKMT,XL1DAM,XLBP,XLCB,XLCB1C,XLCB3,XLDI  2900
     1CP,XLCP3,XLCB,XLCB1W,XLCBB,XLMB1M,XLMBDA,XMID,XMOM1L,XMOMJV,XMTI,YDI  3000
     1,YI,YIMA,Z,WAVLOC ,XIDAMB,XPDAMB,XLMBPR,IABAL                     DI  3100
      COMMON/4/ICAT,YIINT,N3HEEL,THETJM,LIMIT                           DI  3200
    9 DO 10 ISTAT= 1,LIMIT                                              DR  3300
   10 HI(ISTAT) = HIBASC - (XMID-X(ISTAT))*SIN(THETIT)/COS(THETIT)      DR  3400
      GO TO (17,15,16),KW                                               DR  3500
   15 DO 20 ISTAT=1,LIMIT                                               DR  3600
   20 HI(ISTAT)=HI(ISTAT)+HIBAO(ISTAT)                                  DR  3700
      GO TO 17                                                          DR  3800
   16 DO 80 ISTAT=1,LIMIT                                               DR  3900
   80 HI(ISTAT)=HI(ISTAT)+HIHOO(ISTAT)                                  DR  4000
   17 RETURN                                                            DR  4100
      END                                                               DR  4200
```

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```
      FUNCTION FINT01(A,B,C,FACTOR)                                    F1   200
      FINT01=(A**4.0*B*C)*FACTOR                                       F1   300
      RETURN                                                           F1   400
      END                                                              F1   500
```

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```
      FUNCTION FINTP1(XX,A,B,C)                                          FI  200
      FINTP1 = A*XX**2 + B*XX + C                                        FI  300
      RETURN                                                             FI  400
      END                                                                FI  500
```

```
      FUNCTION FINTP2(YIL,YIR,YIL)                                      FI   200
      DIMENSION AIWP3(20),AREA1B(60,20),AREA2B(60),AREA4B(20,30),BML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   400
     1DWL(20),H(60),HICOMP(20),HINOD(60),HIMAR(40),HIOUT(20),HIBAD(60),HDI   500
     1BCOMP(20),ICOMP(2),JMAXAR(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   600
     1AMEIB(8),NCOMP2(8,3,3),NP(60),PERM(18),PERMI(3)                   DI   700
      DIMENSION PERMB(18),RAB(8,8,10),S(60,20),SPB(60),SSBHIP(20),STATNO(DI   800
     160),SECTIM(20),TCBIC(20),TCBB(8,8,10),TCBI(60,20),TCBPB(60),THETBDI   900
     1M(10),TPI(20),TRIM3(8),VCBIC(20),VCBB(8,8,10),VCBI(60,20),VCBPB(60DI  1000
     10),VOL3(20),VOLB(8),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAMB(18DI  1100
     11),XIDAM8(20),XPDAM8(20),ZIW(20),XPDAM(30),XPDAMB(18)             DI  1200
      DIMENSION XKB(20),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCBIC(20DI  1300
     1),XLCB3(20),XLCP3(20),XLCBIW(20),XLCBB(8),XMTI(20),Y(60,20),YI(60)DI  1400
     1,Z(60,20),YIINT(6,39),THETJM(8)                                   DI  1500
      DIMENSION XLVM(20)                                                DI  1600
      COMMON/1/AIMA,AIWP,AIWP3,AREA1B,AREA2B,AREA4B,BML,BMT,CIA,CIALPH,CDI  1700
     1IB,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  1800
     1,HPCOMP,HINOD,HIMAR,HIOUT,HIBAD,HPMAR,H3MAR,H4MAR,HWI,IIAPT,IIBAL,DI  1900
     1IIPWD,IISYM,IIWC,IIWW,IIWL,IPWC,IPWW,IPWL,IBREAK,ICOMP,ICHECK,INITDI  2000
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IV,JBREAK                DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIMESL,NILCBDI  2200
     1,NIPERM,NITRIM,NAME,NAMEIB,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SIGHIP,SPB,SSBHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCB,TCBIC,TCBB,TCBIB,TCBPB,THETJM,THETJT,THEDI  2500
     1TAT,THETBM,TPI,TRIM3,VCBIC,VCBB,VCBIB,VCBPB,VOL                   DI  2600
      COMMON/3/VOLIC,VOLID,VOL3,VOLB,WAVGEN,WCLINC,WEIGHT,WMLINC,WMLMUL,DI  2700
     1WLLINC,X,XIDAM,XIDAMB,XILIM,XIM,XIW,XPDAM,XPDAMB,XPLIM,XPB,XSLIM,XDI  2800
     1SLIM,XTIL,XTIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLCP,XLCB,XLCBIC,XLCB3,XLDI  2900
     1CP,XLCP3,XLCB,XLCBIW,XLCBB,XLMBIP,XLMBDA,XMID,XMOMIL,XMOMJV,XMTIC,YDI  3000
     1,YI,YIMA,Z,WAV,OC ,XIDAM8,XPDAM8,XLMBPB,IABAL                     DI  3100
      COMMON/4/ICAT,YIINT,N3MEEL,THETJM,LIMIT                           DI  3200
      FINTP2 = CIA*YIA + CIB*YII + CIC*YIL                              FI  3300
      RETURN                                                            FI  3400
      END                                                               FI  3500
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      SUBROUTINE FLNATH                                                  FL   200
      DIMENSION LOOP(10)                                                 FL   300
      DIMENSIONAIWP3(20),AREA19(60,20),ARFAP9(60),AREA99(20,30),RML(20),DI   400
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIOOPT(20),DATP(P),DISPL3(20),DI   500
     1DWL(20),H(60),HICOMP(20),HIMOO(60),HIMAH(60),HIOUT(20),HIBAO(60),HDI   600
     1PCOMP(20),ICOMP(8),JMEAH(60,10),JMAX(9),KMAX(20,3),KP(8),NAME(8),NDI   700
     1AME1B(8),NCOMPP(2,3,3),NP(60),PERM(18),PERM(3)                    DI   800
      DIMENSIONPERMP(18),HAB(6,9,10),B(60,20),BPB(60),BTHHIP(20),BTATNO(DI   900
     160),SECTIM(20),TCHIC(20),TCHB(6,9,10),TCOIB(60,20),TCOPB(60),THETDI  1000
     1H(10),TPI(20),THIMJ(6),VCHIC(20),VCHB(6,9,10),VCOIB(60,20),VCOPB(6DI  1100
     10),VOL3(20),VOL8(8),VOLIC(20),WEIGHT(20),X(60),XIDAMP(10),XIDAMPIIDI  1200
     11),XIDAMB(20),XPDAMB(20),XIW(20),XPDAM(10),XPDAMP(18)             DI   1300
      DIMENSIONXPB(60),XKMJ(20),XKML(20),XKMT(20),XLIDAM(10,3),XLCHIC(20DI  1400
     1),XLCB3(20),XLCP3(20),XLCOIW(20),XLCOB(8),XMTI(20),Y(60,20),YI(60)DI  1500
     1,Z(60,20) ,YIINT(6,10),IMPTJH(8)                                  DI   1600
      DIMENSION XLVP(20)                                                 DI   1700
      COMMON/1/AIMA,AIWP,AIWPJ,AREAIB,AREAPB,AREA8B,RML,RMT,CIA,CIALPH,CDI   1800
     11B,CIC,CIP,CIOOPT,CIWP,CONST,DATP,DISPL,DISPL3,DWL,H,HIMABC,HICOMPDI  1900
     1,HPCOMP,HIMOO,HIMAH,HIOUT,HIBAO,HPMAH,HJMAH,HOMAH,HWI,IIAFT,IIMAL,DI  2000
     1IIFWD,IISYM,IIWC,IIWH,IIWL,IPWC,IPWH,IPWL,IMMEAH,ICOMP,ICHENG,INITDI  2100
     1,IRENTI,ISPENO,ISTAT,ISTOP,ITPSTI,ITESTJ,IY,JMMEAH                DI   2200
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIMERL,NIICGDI  2300
     1,NIPERM,NITRIM,NAMP,NAMEIB,NCOMPI,NCOMPP,NNSTAT,NP,NSTAT,NSTATI,NSDI  2400
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERMM,PPMMI,PERMP,RAB,B,RIBHIP,BPB,RIBHIDI  2500
     1P,SPACE,STATNO,SECTIM,TCH,TCHIC,TCHB,TCOIB,TCOPB,THETIM,THETIT,THEDI  2600
     1TDT,THETBM,TPI,THIMJ,VCHIC,VCHB,VCOIB,VCOPB,VOL                   DI   2700
      COMMON/3/VOLIC,VOLIB,VOL3,VOL8,WAVCPN,WCIINC,WEIGHT,WHIINC,WHIMUL,DI   2800
     1WLIINC,X,XIDAM,XIDAMP,XILIM,XIM,XIW,XPDAM,XPDAMP,XPLIM,XPB,XJLIM,XDI  2900
     14LIM,XIIL,XIIT,XKM,XKM3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCBIC,XLCB3),XLDI  3000
     1CP,XLCP3,XLCO,XLCOIW,XLCOB,XLMRIN,XLMRPA,XMID,XMOMII,XMOMJV,XMTI,YDI  3100
     1,YI,YIMA,Z,WAVIOC ,XIDAMB,XPDAMB,XLMRPB,IABAL                     DI   3200
      COMMON/4/ICAT,YIINT,NJWHEEL,THETJH,LIMIT                           DI   3300
C     IF KVOL=1, THE VOLUME OF THE ENTIRE UNDAMAGED SHIP WILL BE         FL   3400
C     CALCULATED                                                         FL   3500
C                                                                        FL   3600
C     IF KVOL=2, VOLUME OF SHIP IS COMPUTED WITH NCOMP1 COMPARTMENTS     FL   3700
C     FLOODED                                                            FL   3800
C                                                                        FL   3900
C     IF KVOL=3, VOLUME OF SHIP IS COMPUTED FROM THE BOW UP TO EACH WEIGHTFL   4000
C     STATION (XIW(I))                                                   FL   4100
C                                                                        FL   4200
C                                                                        FL   4300
C     IF IIBAL=1, SHIP BALANCE WILL START FROM HIMABC=10.0,THETIT=0.0    FL   4400
C     IF IIBAL=2, SHIP BALANCE WILL START FROM WHERE LAST SHIP BALANCE    FL   4500
C     ENDED                                                              FL   4600
C                                                                        FL   4700
C     NCOMP1= THE NUMBER OF DAMAGED COMPARTMENTS                         FL   4800
C                                                                        FL   4900
C                                                                        FL   5000
      KVOL=2                                                             FL   5100
      IIBAL=1                                                            FL   5200
      NCOMP1=1                                                           FL   5300
C                                                                        FL   5400
C     SET WAVE HT=0.0                                                    FL   5500
C                                                                        FL   5600
      KW=1                                                               FL   5700
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C                                                                               FL  8700
C                                                                               FL  8800
      DO 444 I = 1,NSTAT                                                        FL  8900
      LOOP(I)=0                                                                 FL  9000
      N = 1                                                                     FL  9100
  777 PERM(I) = PERM(I)                                                         FL  9200
      JCOUNT = 0                                                                FL  9300
      ICOUNT = 0                                                                FL  9400
C                                                                               FL  9500
C   NIPERM=NUMBER OF DIFFERENT PERMEABILITIES FOR WHICH FLOODABLE               FL  9600
C   LENGTH IS TO BE CALCULATED                                                  FL  9700
C                                                                               FL  9800
      XL(DAM(I,N)=0.50*XLMP                                                     FL  9900
 1111 XLSDAM=0.0                                                                FL 10000
      IF(X(I)-X(1))       100,100,101                                           FL 10100
  100 XL(DAM(I,N)=0.0                                                           FL 10200
      GO TO 6                                                                   FL 10300
C                                                                               FL 10400
  101 IF(X(NSTAT)-X(I))     100,100,102                                         FL 10500
  102 XJMAX=-1000.0                                                             FL 10600
      LICHEK=0                                                                  FL 10700
    7 IF(LICHEK)     40,40,41                                                   FL 10800
   41 GO TO (410,411),LICHEK                                                    FL 10900
  410 XL(DAM(I,N)=(X(I)-X(1))*2.0                                               FL 11000
      GO TO 6                                                                   FL 11100
  411 XL(DAM(I,N)=(X(NSTAT)-X(1))*2.0                                           FL 11200
      GO TO 6                                                                   FL 11300
   40 IF(X(I)-X(1)-XL(DAM(I,N)/2.0)      42,42,44                             FL 11400
   44 IF(X(NSTAT)-X(I)-XL(DAM(I,N)/2.0)     43,43,6                            FL 11500
   43 LICHEK=2                                                                  FL 11600
      XL(DAM(I,N)=2.0*(X(NSTAT)-X(I))                                           FL 11700
      GO TO 6                                                                   FL 11800
   42 LICHEK=1                                                                  FL 11900
      XL(DAM(I,N)=2.0*(X(I)-X(1))                                               FL 12000
    6 IF(XL(DAM(I,N))     601,600,600                                           FL 12100
  601 XL(DAM(I,N)=0.0                                                           FL 12200
  600 XLICOR=XLSDAM-XL(DAM(I,N)                                                 FL 12300
C                                                                               FL 12400
      XLSDAM=XL(DAM(I,N)                                                        FL 12500
C                                                                               FL 12600
C   XLSDAM=DAMAGE LENGTH OF PREVIOUS ITERATION                                  FL 12700
C                                                                               FL 12800
      X(DAM (I)=X(I)-XL(DAM(I,N)/2.0                                            FL 12900
      XRDAM (I)=X(I)+XL(DAM(I,N)/2.0                                            FL 13000
C                                                                               FL 13100
C                                                                               FL 13200
  300 CALL HAL                                                                  FL 13300
      WRITE(10,999) X(I),ICOUNT,JCOUNT,IFAL,XL(DAM(I,N),XLSDAM,(H(LLL),FL 13301
     1LLL = 1,NSTAT)                                                            FL 13302
  999 FORMAT(' X=',F8.2,' TRY ICOUNT=',I3,' TRY JCOUNT=',I3,' IFAL=',I3,/  FL 13303
     1' CURRENT LENGTH DAMAGE=',F8.2,' PREV. LENGTH DAMAGE=',F8.2,/' DRAFTFL 13304
     2S=' 30F4.0,/)                                                             FL 13305
      IF(IFAL-8)    301,303,303                                                 FL 13400
  303 IFAL = 4                                                                  FL 13499
      ICOUNT=ICOUNT+1                                                           FL 13500
      IF(ICOUNT-99) 1139,312,312                                                FL 13501
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  310 WRITE(61,311) X(I),XLIDAM(I,N),PERM(I)                              FL 10500
  311 FORMAT(//* AT STATION LOCATED*F8.2,* FT FROM FP, LENGTH OF DAMAGE   FL 10501
     1OF*F8.2,* FT, AND PERMEABILITY OF*F4.2,* SHIP ABSOLUTELY WILL NOT   FL 10502
     2BALANCE*//)                                                         FL 10503
      XLIDAM(I,N) = 0.                                                    FL 10504
      GO TO 4                                                             FL 10505
 3199 XLICOR=ABS(0.8*XLICOR)                                              FL 10600
      GO TO 3                                                             FL 10700
  301 TIBAL=0                                                             FL 10800
C                                                                         FL 10900
  302 HSMAR=1000.0                                                        FL 11000
C   DETERMINE THE LEAST DISTANCE FROM WATER LINE TO MARGIN LINE           FL 11100
C                                                                         FL 11200
C                                                                         FL 11300
      DO 18  J=1,NSTAT                                                    FL 11400
      HPMAR=HIMAR(J)-H(J)                                                 FL 11500
      IF(HSMAR-HPMAR)   18,12,10                                          FL 11600
   10 HSMAR=HPMAR                                                         FL 11700
   18 CONTINUE                                                            FL 11800
      IF(ABS(HSMAR)-0.05) 4,4,14                                          FL 11900
   14 ICOUNT = ICOUNT + 1                                                 FL 12000
      IF(ICOUNT .LT. 10) GO TO 18                                         FL 12100
      IF(HSMAR*H3MAR)16,17,17                                             FL 12200
   16 JCOUNT = 0                                                          FL 12300
      GO TO 91                                                            FL 12400
   17 JCOUNT = JCOUNT + 1                                                 FL 12500
      IF(JCOUNT-2)809,807,18                                              FL 12600
  807 IF(XLICOR-1.0)     18,18,808                                        FL 12700
  808 XLICOR=XLICOR/10.0                                                  FL 12800
      GO TO 94                                                            FL 12900
   18 XLIDAM(I,N)=HSMAR*(FLIUAM(I,N)-XLSDAM)/(HSMAR-H3MAR)+XLIDAM(I,N)    FL 13000
      LOOP(I)=LOOP(I)+N*(10**(N-1))                                       FL 13100
      GO TO 4                                                             FL 13200
   19 IF(H3MAR+100.0)   80,81,81                                          FL 13300
C                                                                         FL 13400
C   IF(H3MAR+100.0) IS NEGATIVE,CURRECTION CANNOT BE BASED ON PAST        FL 13500
C   EXPERIENCE,HENCE AN ARBITRARY CORRECTION IS MADE                      FL 13600
C                                                                         FL 13700
C                                                                         FL 13800
C   H3MAR=LEAST DISTANCE FROM WATER LINE TO MARGIN LINE OF PREVIOUS       FL 13900
C   ITERATION                                                             FL 14000
C                                                                         FL 14100
   80 XLICOR=0.1*XLIDAM(I,N)                                              FL 14200
      GO TO 82                                                            FL 14300
   81 IF (ABS(H3MAR - HSMAR) * .000001) 1111,1111,941                     FL 14400
  941 XLICOR=XLICOR*ABS(HSMAR/(H3MAR-HSMAR))                              FL 14500
   82 H3MAR=HSMAR                                                         FL 14600
      XLICOR=ABS(XLICOR)                                                  FL 14700
      IF(XLICOR-0.02)*XLMP)     94,84,353                                 FL 14800
  353 XLICOR=0.02*XLMP                                                    FL 14900
   84 IF(HSMAR)  3,4,5                                                    FL 15000
    3 XLIDAM(I,N)=XLIDAM(I,N)-XLICOR                                      FL 15100
      LICHEK=0                                                            FL 15200
      GO TO 6                                                             FL 15300
    5 XLIDAM(I,N)=XLIDAM(I,N)+XLICOR                                      FL 15400
      GO TO 7                                                             FL 15500
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      6 IF(N.EQ.NIPERM) GO TO 444                                                    FL 19500
        N=N+1                                                                        FL 19510
        IF(I.NAL.EQ.6) GO TO 770                                                     FL 19515
        IF(LICHEK .EQ. 0) XLIDAM(I,N)=XLIDAM(I,N-1)*PERM(I(N-1))/PERM(I(N)           FL 19520
        H3MAR = -1000.0                                                              FL 19521
        ICOUNT = 0                                                                   FL 19522
        JCOUNT = 0                                                                   FL 19523
        PERM(I) = PERM(I,N)                                                          FL 19524
        GO TO 600                                                                    FL 19525
  444 CONTINUE                                                                       FL 19530
C                                                                                    FL 19700
C    OUTPUT SECTION                                                                  FL 19800
C                                                                                    FL 19900
  800 FORMAT(1H1,9HIP=,I4,4X,9HIDENTIAL NUMBER=,I3,9X,9HDATE=,2A6/)                  FL 20000
      DO 900   N=1,NIPERM,1                                                         FL 20100
      XN=N                                                                         FL 20200
      WRITE (6,804)(NAME(I), I = 1,N), (PERMNO,(DATE(I), I = 1,2)                  FL 20300
      WRITE (6,890)                                                                FL 20400
      WRITE (6,891)                                                                FL 20500
      DO 900 I = 1,NSTAT                                                           FL 20600
      LOOP1=LOOP(I)/10                                                             FL 20700
      LOOP1=LOOP(I)-10*LOOP1                                                       FL 20800
      IF(LOOP1-N)      90,90,95                                                    FL 20900
   95 WRITE (6,892) X(I),STATNO(I),PERM(I,N),XLIDAM(I,N)                           FL 21000
      GO TO 500                                                                    FL 21100
   90 XIDAM(I)=X(I)-XLIDAM(I,N)/2.0                                                FL 21200
      XRDAM(I)=X(I)+XLIDAM(I,N)/2.0                                                FL 21300
      WRITE (6,893)X(I),STATNO(I),PERM(I,N),XLIDAM(I,N),XIDAM(I),XRDAM(I)          FL 21400
  900 LOOP(I)=LOOP(I)/10                                                           FL 21500
  890 FORMAT(////1H ,10HFLOODABLE LENGTH///)                                       FL 21600
  891 FORMAT(//       1H ,          2X, 10H LOCATION ,                             FL 21700
     1 10H   STATION,2X,     10H   PERMEABILITY,10H   FLOODABLE LENGTH/           FL 21800
     2 1H (FT FROM FP),2X,4H(FRI)//)                                               FL 21900
  892 FORMAT(1H0,2X,                                                               FL 22000
     1          2F10.1,F10.1,F10.3,4X,27HTHIS ANSWER IS APPROXIMATE,/             FL 22100
     2 1H ,12HMORE THAN 6 STATIONS ARE NEEDED NEAR X=,F6.0,2X,                     FL 22200
     3                                                 9HAND/OR X=,F6.0/)          FL 22300
  893 FORMAT(1H ,2X,2F10.1,F10.1,F10.3/)                                           FL 22400
C                                                                                  FL 22500
C                                                                                  FL 22600
      RETURN                                                                       FL 22700
      END                                                                          FL 22800
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      SUBROUTINE GENERATE                                                    GE   200
      DIMENSION INBLK(4),INKS(4)                                             GE   210
      DIMENSIONA(WP3(20),AREA(S(60,20),AREAPS(60),AREA4S(20,30),BML(20),DI   400
     1BM?(20),C(ALPM(20),C(P(20),C(WP(20),C(DOFT(20),DATE(2),DISPL3(20),DI   300
     1DWL(20),M(60),M(COMP(20),M(MOO(60),M(MAR(40),M(OUT(20),M(BAO(60),MDI   400
     1COMP(20),(COMP(8),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   500
     1AME(S(8),NCOMPP(20,3,3),NP(60),PERM(10),PERM1(3)                      DI   600
      DIMENSIONPERM2(10),NAB(5,5,10),S(60,20),SPS(60),S3SMIP(20),STATNO(DI   700
     160),SECT(M(20),TCB(C(20),TCBS(5,5,10),TCB(S(60,20),TCB2S(60),TMET(DI   800
     1M(10),TP((20),TRIM3(6),VCB(C(20),VCBS(5,5,10),VCB(S(60,20),VCB2S(6DI   900
     10),VOL3(20),VOL(S(9),VOL(C(20),WRIGHT(20),X(60),X(DAM(30),X(DAMP()DI  1000
     11),X(DAM6(20),X2DAM6(20),X(W(20),X2DAM(30),X2DAME(10)                 DI  1100
      DIMENSIONXP6(60),XMB3(20),XMML(20),XMMT(20),XL(DAM(30,3),XLCB(C(20DI  1200
     1),XLCB3(20),XLCP3(20),XLCB(W(20),XLCBS(6),XMT((20),Y(60,20),Y((60)DI  1300
     1,Z(60,20),Y((NT(6,30),TME(3M(9)                                       DI  1400
      DIMENSION XLVM(20)                                                     DI  1490
      COMMON/1/AIMA,A(WP,A(WP3,AREA(S,AREAPS,AREA4S,BML,BMT,C(A,C(ALPM,CDI  1500
     1(A,C(C,C(P,C(DOFT,C(WP,CONST,DATE,DISPL,DISPL3,DWL,M,M(BABC,M(COMPDI  1600
     1,MPCOMP,M(MOO,M(MAR,M(OUT,M(BAO,M2MAR,M3MAR,M4MAR,MW1,(|APT,I|BAL,DI  1700
     1I|PWD,I|SYM,I|WC,I|WM,I|WL,I2WC,I2WM,I2WL,IBREAK,ICOMP,ICHECKV,INITDI  1800
     1,ISENTL,ISENNO,ISTAT,IS|OP,I?ESTI,I?EST3,|Y,JBREAK                    DI  1900
      COMMON/2/JMAX,M,KK,KMAX,KP,KVOL,KW,M,MA,N|OUTT,N|DSPL,N|MEEL,N|LCODI  2000
     1,N|PERM,N|TRIM,NAME,NAMS|S,NCOMP|,NCOMP2,NNSTAT,NP,NSTAT,NSTAT|,NSDI  2100
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,S|SMIP,SPS,S3SMIDI  2200
     1P,SPACE,STATNO,SECT|M,TCB,TCB|C,TCBS,TCB|S,TCB2S,TMETIM,TMETIT,TMEDI  2300
     1TDT,TMETSM,TPI,TRIM3,VCB|C,VCBS,VCB|S,VCB2S,VOL                       DI  2400
      COMMON/3/VOL|C,VOL|D,VOL3,VOL9,WAVCEN,WC|INC,WE|GHT,WH|INC,WH|MUL,DI  2500
     1WL|INC,X,X|DAM,X|DAM2,X|LIM,X|M,X|W,X2DAM,X2DAM2,X2LIM,X2LIM,XDI  2600
     14LIM,X|IL,X|IT,XKB,XKB3,XKML,XKMT,XL|DAM,XLBP,XLCB,XLCB|C,XLCB3,XLDI  2700
     1CP,XLCP3,XLCB,XLCB|W,XLCBS,XLMB|R,XLMBDA,XMID,XMOM1L,XMOM3V,XMT|,YDI  2800
     1,Y|,Y|MA,Z,WAVLOC ,X|DAM6,X2DAM6,XLMBPR,IBAL                          DI  2900
      COMMON/4/ICAT,V|INT,N3MEEL,|METSM,LIMIT                                DI  3000
      DIMENSION  XIS(30),YIS(20,20),ZIS(30,20),YIST(2,20),ZIST(2,20),       DI   200
     1ZINT(4,10),YINT(4,10),XBLK(4),NINT(4),NPIS(30),JNPIS(30,10),          DI   300
     2JBPST(2,10),NPIST(2)                                                  DI   400
      COMMON XIS,YIS,ZIS,XBLK,YINT,ZINT,NPIS,NINT,YIST,ZIST,NPIST,JBPIS,DI   500
     1JBPST,INDX3,JSTAT,KSTAT,LSTAT,MSTAT,NBULK,LBULK,JCAT                  DI   600
      LBULK=1                                                               GE   700
      IFCT = 1                                                              GE   800
      JSTAT=1                                                               GE   900
      DO 944 ISTAT = 1,NSTAT                                                GE  1000
      IF(X(ISTAT)-XBLK(1))944,944,9010                                      GE  1100
  944 CONTINUE                                                              GE  1200
 9010 KSTAT = ISTAT                                                         GE  1300
      MSTAT= KSTAT                                                          GE  1400
  919 IF(LBULK-NBULK)20,20,100                                              GE  1500
   20 INBLK(LBULK) = JSTAT-LSTAT*(IFCT-1)                                   GE  1600
      INKST(LBULK) = KSTAT                                                  GE  1700
      XIS(JSTAT)=XBLK(LBULK)                                                GE  1800
   65 JSTAT=JSTAT+1                                                         GE  1900
      IF(LBULK-NBULK) 70,100,70                                             GE  2000
   70 IF(X(KSTAT)-XBLK(LBULK+1)) 72,72,75                                   GE  2100
   72 CALL STORE                                                            GE  2200
      XIS(JSTAT)=X(KSTAT)                                                   GE  2300
      KSTAT = KSTAT + 1                                                     GE  2400
      GO TO 65                                                              GE  2500
```

```
 90  LBULK=LBULK+1                                                  0E  2300
     GO TO 910                                                      0E  2400
100  GO TO (110,110,220),ICAT                                       0E  2500
110  LSTAT= JSTAT -1                                                0E  2550
     IF(LSTAT .GT. 0) GO TO 180                                     0E  2551
     LSTAT = 3                                                      0E  2552
     XIS(LSTAT) = XIS(2)                                            0F  2553
     XIS(2) =(XIS(LSTAT) + XIS(1))/2.0                              0E  2554
     INBLK(2) = 3                                                   0E  2555
     JSTAT = 2                                                      0E  2556
     CALL SECTN                                                     0E  2557
     JSTAT = 0                                                      0E  2558
     IPCT = 3                                                       0E  2559
140  DO 170 I = 1,LSTAT                                             0E  2560
     LL = 1+LSTAT                                                   0E  2570
170  XIS(LL) = XIS(I)                                               0E  2580
     IF(IPCT .EQ. 3) GO TO 210                                      0E  2590
200  GO TO (210,210,220),ICAT                                       0E  2600
210  ICAT = 3                                                       0E  2700
     LNULK = 1                                                      0E  2800
     IPCT = 2                                                       0E  2850
     KSTAT = MSTAT+NSTAT                                            0E  2900
     GO TO 20                                                       0E  3000
220  ICAT = 2                                                       0E  3100
230  IMOD=1                                                         0E  3200
     LOW=1                                                          0E  3400
     IF(XIS(1)-X(1))  240,235,240                                   0E  3500
235  KSTAT=1                                                        0E  3600
     JSTAT = 1                                                      0E  3650
     CALL STORE                                                     0E  3700
     CALL MODIFY(IMOD)                                              0E  3750
     LOW=2                                                          0E  3800
240  DO 245 LBULK=LOW,NBULK                                         0E  3900
     JSTAT = INBLK(LNULK)                                           0E  4000
     KSTAT = INKST(LBULK)                                           0E  4100
     CALL SECTN                                                     0E  4200
     CALL MODIFY(IMOD)                                              0E  4400
245  CONTINUE                                                       0E  4500
     LBULK = 1                                                      0E  4700
     IMOD = 2                                                       0E  4800
     DO 270 JSTAT = 2,LSTAT                                         0E  4900
     KSTAT = 1                                                      0E  5010
253  IF(JSTAT - INBLK(LBULK+1)) 260,270,255                         0E  5100
255  LBULK = LBULK + 1                                              0E  5200
260  CALL MODIFY(IMOD)                                              0E  5300
270  CONTINUE                                                       0E  5400
     CALL OUTPT                                                     0E  5500
     RETURN                                                         0E  5600
     END                                                            0E  5700
```

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      SUBROUTINE MILIM                                                          MI   200
      DIMENSIONA1WP3(20),AREA1S(60,20),AREAPS(60),AREA4S(20,30),BML(20),DI   300
     1BMT(20),C1ALPH(20),C1P(20),C1WP(20),C1DOPT(20),DATE(2),DISPL3(20),DI   400
     1DWL(20),H(60),HICOMP(20),HIMOO(60),HIMAR(40),HIOUT(20),HISAO(40),HDI   500
     1RCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),NP(8),NAME(8),NDI   600
     1AME1S(8),NCOMP2(20,3,3),NP(60),PERM1(10),PERM1(3)                     DI   700
      DIMENSIONPERM2(10),RAB(5,5,10),S(40,20),SPS(60),STSHIP(20),STATNO(DI   800
     160),SECTIM(20),TCA1C(25),TCB5(5,5,10),TC61S(60,20),TCGPS(60),THETSDI   900
     1M(10),TPI(20),TRIM3(6),VCA1C(25),VCA5(5,5,10),VC61S(60,20),VCGPS(6DI  1000
     10),VOL3(20),VOL5(5),VOL1C(25),WEIGHT(20),X(40),XIDAM(30),XIDAM2(15DI  1100
     1),XIDAM5(20),XPDAM5(20),XIW(20),XPDAM(30),XPDAM2(15)                  DI  1200
      DIMENSIONXPS(20),XKB3(20),XKML(20),XKMT(20),XLIDAM(10,3),XLCB1C(20DI  1300
     1),XLCB3(20),XLCP3(20),XLCB1W(20),XLCB5(5),XMTI(20),Y(60,20),YI(60)DI  1400
     1,Z(60,20) ,YIINT(4,30),THETSM(5)                                      DI  1500
      DIMENSION XLVM(20)                                                    DI  1600
      COMMON/1/AIMA,AIWP,AIWP3,AREA1S,AREAPS,AREA4S,BML,BMT,C1A,C1ALPH,CDI  1700
     11R,C1C,C1P,C1DOPT,C1WP,CONST,DATE,DISPL,DISPL3,DWL,H,HIRADC,HICOMPDI  1800
     1,HPCOMP,HIMOO,HIMAR,HIOUT,HISAO,HPMAR,H3MAR,H4MAR,HW1,IIAFT,IIBAL,DI  1900
     1IIFWD,IISYM,IIWC,IIWH,IIWL,ISWC,IPWH,IPWL,IWREAK,ICOMP,ICHERK9,INITDI  2000
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                    DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHEEL,NILCGDI  2200
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTATI,NSDI  2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SHIP,SPS,STSHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCB,TCB1C,TCB5,TC61S,TCGPS,THETIM,THETIT,THEDI  2500
     1T2T,THETSM,TPI,TRIM3,VCB1C,VCB5,VCB1S,VCGPS,VOL                       DI  2600
      COMMON/3/VOL1C,VOL1D,VOL3,VOL5,WAVCRN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2700
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPS,XSIIM,XDI  2800
     14LIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCB1C,XLCB1,XLDI  2900
     1CP,XLCP3,XLCG,XLCG1W,XLCG5,XLKB1R,XLMBDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  3000
     1YI,YIMA,Z,WAVLOC ,XIDAM5,XPDAM5,XLMBPR,IABAL                          DI  3100
      COMMON/4/ICAT,YIINT,N3HBEL,THETSM,LIMIT                               DI  3200
      VOL1=VOL1D                                                            MI  3300
      IIBAL=1                                                               MI  3400
      XLCG1=XLCG                                                            MI  3500
C                                                                           MI  3600
C                                                                           MI  3700
C   SET WAVE HT=0.0                                                         MI  3800
      KW=1                                                                  MI  3900
C                                                                           MI  4000
      DO 40   J=1,2                                                         MI  4100
C                                                                           MI  4200
      JIMAX=JMAX(J)                                                         MI  4300
      DO 40  JI=1,JIMAX                                                     MI  4400
      KIMAX=KMAX(J,JI)                                                      MI  4500
      DO 703   KI=1,KIMAX                                                   MI  4600
      NCOMP3=NCOMP2(J,JI,KI)                                                MI  4700
      PERM(K)=PERM2(NCOMP3)                                                 MI  4800
      XIDAM(K)=XIDAM2(NCOMP3)                                               MI  4900
  703 XPDAM(K)=XPDAM2(NCOMP3)                                               MI  5000
      NCOMP1=KIMAX                                                          MI  5100
  7010 IF(JI-2)       7018,7017,7018                                        MI  5200
  7018 WRITE (6,806)(NAME(I), I = 1,8), ISERNO,(DATE(I), I = 1,2)           MI  5300
   806 FORMAT(6H1SHIP-,4X8A4,5X14HSERIAL NUMBER-I6,5X6HDATE-2A4/)           MI  5400
      WRITE (6,100)                                                         MI  5500
  7017 GO TO (2051,2048),J                                                  MI  5600
 2048 WRITE (6,2055)JI                                                      MI  5700
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 2056 FORMAT(//                                                          M1  8700
     1        13H AFTER GROUP  ,I3, 38H CONTAINING THE FOLLOWING COMPARTM1  8800
     2MENTS   11H IS FLOODED     /)                                      M1  8900
      GO TO 2057                                                        M1  9000
 2061 WRITE (6,2054) J                                                  M1  9100
 2054 FORMAT(//16H FORWARD GROUP  ,I3,38H CONTAINING THE FOLLOWING COMPAM1  9200
     1RTMENTS    , 11H IS FLOODED             / )                       M1  9300
 2057 CONTINUE                                                          M1  9400
      WRITE (6,3002)                                                    M1  9500
 3002 FORMAT(4X,                                                        M1  9600
     1        18H COMPARTMENT 3X,13H  FOREWARD   13H    AFTER    ,18HPERMM1  9700
     2EABILITY/  3X                                                     M1  9800
     3 ,        12H   NUMBER   3X,10H LIMIT (FT       3X,10H LIMIT (FT , M1  9900
     4/21X,6HFROM FP),4X , 6HFROM FP)          /)                      M1 10000
      WRITE (6,2000)(NCOMPS(J,J1,M),X1DAM(M),X2DAM(M),PERM(M),M=1,KIMAX)M1 10100
 2000 FORMAT(118,3X,3F12.3)                                             M1 10200
C                                                                       M1 10300
      WRITE (6,103)                                                     M1 10400
      DO 40    I=1,6                                                    M1 10500
      GO TO (301,300),J                                                 M1 10600
  301 TRIM(F=I-7                                                        M1 10700
      GO TO 303                                                         M1 10800
  300 TRIM(F=7-I                                                        M1 10900
  303 CONTINUE                                                          M1 11000
      THETIT=TRIM(F/(3.0*SQRT(XLMP))                                    M1 11100
      M1BASC=10.0                                                       M1 11200
      M3MAR=-1000.0                                                     M1 11300
      CALL DRAFT                                                        M1 11400
C                                                                       M1 11500
C    GET MINIMUM DISTANCE BETWEEN WATERLINE AND MARGIN LINE             M1 11600
C                                                                       M1 11700
    7 M4MAR=1000.0                                                      M1 11800
C                                                                       M1 11900
      DO 12    KCNT=1,NSTAT                                             M1 12000
      M2MAR=M1MAR(KCNT)-M(KCNT)                                         M1 12100
      IF(M4MAR-M2MAR)    12,12,10                                       M1 12200
   10 M4MAR=M2MAR                                                       M1 12300
   12 CONTINUE                                                          M1 12400
C                                                                       M1 12500
C                                                                       M1 12600
      IF(ABS(M4MAR)-4.04) 4,4,15                                        M1 12700
   15 IF(M3MAR+100.0)    80,81,81                                       M1 12800
   80 DLTIM=0.1*M1BASC                                                  M1 12900
      GO TO 82                                                          M1 13000
   81 DLTIM=DLTIM *ABS(M4MAR/(M3MAR-M4MAR))                             M1 13100
   82 M3MAR=M4MAR                                                       M1 13200
      DLTIM=ABS(DLTIM)                                                  M1 13300
   84 IF(M4MAR)    3,4,5                                                M1 13400
    3 DLTIM = - DLTIM                                                   M1 13500
    5 DO 60    KCNT=1,NSTAT                                             M1 13600
   60 M(KCNT)=M(KCNT)+DLTIM                                             M1 13700
      M1BASC = M1BASC + DLTIM                                           M1 13800
C                                                                       M1 13900
C                                                                       M1 14000
      GO TO 7                                                           M1 14100
    4 CONTINUE                                                          M1 14200
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      THETBT=THETIT*57.2958                                                    M1  11300
C                                                                              M1  11400
      KVOL=2                                                                   M1  11500
      CALL VOLUME                                                              M1  11600
      VOL10=VOL                                                                M1  11700
C                                                                              M1  11800
C                                                                              M1  11900
      XLCG = XLCB                                                              M1  12000
      KVOL=1                                                                   M1  12100
C     KVOL=1 FOR NO DAMAGE                                                     M1  12200
C                                                                              M1  12300
      CALL BAL                                                                 M1  12400
      VOL2=VOL/35.0                                                            M1  12500
      WRITE (6,106)THETBT,H(11FWD),H(11AFT) ,VOL2,XLCG                         M1  12600
   40 CONTINUE                                                                 M1  12700
      VOL10=VOL1                                                               M1  12800
      XLCG=XLCG1                                                               M1  12900
      RETURN                                                                   M1  13000
  104 FORMAT(///31H                  LIMITING DRAFTS)                          M1  13100
  103 FORMAT(//1H ,                                                            M1  13200
     1        48HTRIM,DEGREES      LIM DRAFT FWD     LIM DRAFT AFT           M1  13300
     2,6X,12HDISPLACEMENT  ,8X,31H LCG (FT FROM AMIDSHIPS, + FWD)  /          M1  13400
     357X,7H (TONS) /)                                                         M1  13500
  105 FORMAT(30H              AFT OF AMIDSHIPS PLANNED)                        M1  13600
  106 FORMAT(1H ,F18.4,4F18.4)                                                 M1  13700
      END                                                                      M1  13800
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      SUBROUTINE HYDRO                                                  HY   200
      DIMENSION MAS(20)                                                 HY   300
      DIMENSION TCB(20)                                                 HY   400
      DIMENSIONAIWP3(20),AREA3(60,20),AREA2B(60),AREA4B(20,30),BML(20),DI   500
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL3(20),DI   600
     1DWL(20),H(60),HICOMP(20),HIMOO(60),HIMAR(60),HIOUT(20),HISAO(60),HDI   700
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   800
     1AME1B(8),NCOMP2(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   900
      DIMENSIONPERM2(10),MAB(5,5,10),S(60,20),SPB(60),SJBHIP(20),SIATNO(DI  1000
     160),SECTIM(20),TCB1C(20),TCB3(5,5,10),TCB1B(60,20),TCB2B(60),THETDI  1100
     1M(10),TPI(20),TRIM3(6),VCB1C(20),VCB3(5,5,10),VCB1B(60,20),VCB2B(6DI  1200
     10),VOL3(20),VOL3(5),VOL1C(20),WEIGHT(20),X(60),XIDAM(30),XIDAMB(10DI  1300
     1),XIDAM0(20),XPDAM0(20),XIW(20),XPDAM(30),XPDAMB(10)              DI  1400
      DIMENSIONXBB(60),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCB1C(20DI  1500
     1),XLCB3(20),XLCP3(20),XLCB1W(20),XLCB2B(5),XMTI(20),Y(60,20),Y1(60)DI  1600
     1,Z(60,20),YLINT(4,30),THETJM(5)                                   DI  1700
      DIMENSION XLVR(20)                                                DI  1800
      COMMON/1/AIMA,AIWP,AIWP3,AREA1B,AREA2B,AREA4B,BML,BMT,CIA,CIALPH,CDI  1900
     11B,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  2000
     1,H2COMP,HIMOO,HIMAR,HIOUT,HISAO,H2MAR,H3MAR,H4MAR,HW1,IIAFT,IIBAL,DI  2100
     1IIFWD,IIBYM,IIWC,IIWM,IIWL,IPWC,IPWM,IPWL,IBREAK,ICOMP,ICHECK,INITDI  2200
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI  2300
      COMMON/2/JMAX,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIMEEL,NILCGDI  2400
     1,NIPERM,NITRIM,NAME,NAME1B,NCOMP1,NCOMP2,NNBSTAT,NP,NSTAT,NSTAT1,NSDI  2500
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAD,S,SJBHIP,SPB,SJBHIDI  2600
     1P,SPACE,STATNO,SECTIM,TCB,TCB1C,TCB3,TCB1B,TCB2B,THETJM,THETJT,THEDI  2700
     1TAT,THETBM,TPI,TRIM3,VCB1C,VCB3,VCB1B,VCB2B,VOL                   DI  2800
      COMMON/3/VOL1C,VOL1D,VOL3,VOL5,WAVCRN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2900
     1WLIINC,X,XIDAM,XIDAMB,XILIM,XIM,XIW,XPDAM,XPDAMB,XPLIM,XPB,XJLIM,XDI  3000
     1KLIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCB1C,XLCB3,XLDI  3100
     1CF,XLCP3,XLCG,XLCG1W,XLCB2B,XLMBIM,XLMBDA,XMID,XMOMIL,XMOMJV,XMTI,YDI  3200
     1,Y1,YIMA,Z,WAVLOC ,XIDAM0,XPDAM0,XLMBPR,IABAL                     DI  3300
      COMMON/4/ICAT,YLINT,NJMEEL,THETJM,LIMIT                           DI  3400
      WRITE (6,806)(NAME(I),I=1,8),ISERNO,(DATE(I),I=1,2)               HY  3500
      WRITE (6,9019)                                                    HY  3600
 9019 FORMAT(       //                                                 HY  3700
     1      13HOHYDROSTATICS   /73HOTHE FOLLOWING PAGES CONTAIN THE RESUHY  3800
     2LTS OF THE HYDROSTATIC CALCULATIONS. 70H THIS IS AN OUTPUT OF SUBRHY  3900
     3OUTINE HYDRO                                                      HY  4000
     4//22H UNITS AND DEFINITIONS      /)                               HY  4100
      WRITE (6,6010)                                                    HY  4200
 6010 FORMAT(                                                           HY  4300
     1 34H AREAS IN TABLE OF SECTIONAL AREAS ARE IN SQUARE FEET./       HY  4400
     2 69H CIDOFT = CHANGE IN DISPLACEMENT FOR ONE FOOT TRIM BY STERN INHY  4500
     3 TONS./                                                           HY  4600
     4 32H DISPLACEMENT = DISPLACEMENT IN LONG TONS./                   HY  4700
     5 30H DRAFT = HEIGHT ABOVE BASELINE IN FEET.          )           HY  4800
 6015 FORMAT(                                                           HY  4900
     1 38H KB = HEIGHT OF CENTER OF BUOYANCY ABOVE BASELINE IN FEET./   HY  5000
     2 93H LCB = LONGITUDINAL CENTER OF BUOYANCY OF DISPLACED VOLUME IN HY  5100
     3FEET FROM AMIDSHIPS (+ IS FWD)./                                  HY  5200
     4 70H LCF = LONGITUDINAL CENTER OF FLOTATION IN FEET FROM AMIDSHIPSHY  5300
     5 (+FWD).          )                                              HY  5400
      WRITE (6,6020)                                                    HY  5500
      WRITE (6,6015)                                                    HY  5600
 6020 FORMAT(                                                           HY  5700
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     136H LONG. KM - LONGITUDINAL KM IN FEET./                                  HY  5700
     836H LONG. BM - LUNGITUDINAL BM IN FEET./                                  HY  5800
     346H MTI= MOMENT TO TRIM ONE INCH IN FOOT TONS./                           HY  5900
     4 98H PRISMATIC COEFFICIENT - BASED ON DESIGN DRAFT(DWL) AND THE MAHY  6000
     8XIMUM STATION AREA AT THE DWL.)                                           HY  6100
      WRITE (6,6030)                                                            HY  6200
6030 FORMAT(                                                                    HY  6300
     131H TPI - TONS PER INCH IMMERSION,/                                       HY  6400
     8       34H TRNSV BM - TRANSVERSE BM IN FEET./                             HY  6500
     334H TRNSV KM - TRANSVERSE KM IN FEET./                                    HY  6600
     452H VOLUME - VOLUME OF SHIP DISPLACEMENT IN CUBIC FEET.)                  HY  6700
      WRITE (6,6040)                                                            HY  6800
6040 FORMAT(                                                                    HY  6900
     178H WETTED SURFACE - SURFACE AREA OF WETTED PORTION OF HULL IN SQUHY  7000
     8ARE FEET./                                                                HY  7100
     383H WPLANE AREA - AREA OF THE WATERPLANE IN SQUARE FEET./                 HY  7200
     4111H WPLANE COEF - WATERPLANE COEFFICIENT BASED ON BEAM AT DESIGN HY  7300
     8DRAFT OF STATION OF MAXIMUM AREA AT DESIGN DRAFT.)                        HY  7400
      WRITE (6,6041)                                                            HY  7500
6041 FORMAT(1H0H WPLANE I COEF - WATERPLANE INERTIA COEFFICIENT BASED ONHY  7600
     1N BEAM AT DESIGN DRAFT OF STATION OF MAXIMUM AREA AT DESIGN DRAFT)HY  7700
       KVOL = 1                                                                 HY  7800
      KW = 1                                                                    HY  7900
      IF(NITRIM)310,300,310                                                     HY  8000
  300 TRIM3(1)=0.0                                                              HY  8100
      NITRIM=1                                                                  HY  8200
      GO TO 311                                                                 HY  8300
  310 NITRIM=NITRIM+1                                                           HY  8400
      TRIM3(NITRIM)=0.0                                                         HY  8500
  311 IF(NJHEEL)440,440,444                                                     HY  8600
  440 THETJH(1)=0.                                                              HY  8700
      NJHEEL=1                                                                  HY  8800
      GO TO 446                                                                 HY  8900
  444 NJHEEL =NJHEEL +1                                                         HY  9000
      THETJH(NJHEEL)=0.                                                         HY  9100
  446 DO 380 IHEEL= 1,NJHEEL                                                    HY  9200
      THETIH = THETJH(IHEEL)*.01745329                                          HY  9300
      DO 380 ITRIM= 1,NITRIM                                                    HY  9400
      THETIT = ATAN(TRIM3(ITRIM)/ALBP)                                          HY  9500
      DO 10 IWL = 1,NWL                                                         HY  9600
      MIOABC = MIOUT(IWL)                                                       HY  9700
      CALL VOLUME                                                               HY  9800
      CALL WPLANE                                                               HY  9900
      DO 400 ISTAT = 1, NSTAT                                                   HY 10000
  400 AREA4B(IWL,ISTAT) = AREABS(ISTAT)                                         HY 10100
      XLCB3(IWL) = XLCB                                                         HY 10200
      VOL3(IWL) = VOL                                                           HY 10300
      RA3(IWL)= TCB/COS(THETIH)+XKB*SIN(THETIH)                                 HY 10400
     1-TCB*SIN(THETIH)**2/COS(THETIH)                                           HY 10401
      TCB3(IWL) = TCB                                                           HY 10500
      XKB3(IWL) = XKB                                                           HY 10600
      DISPL3(IWL) = DISPL                                                       HY 10700
      SSHWP(IWL) = SISHIP                                                       HY 10800
      AIWP3(IWL) = AIWP                                                         HY 10900
      XLCF3(IWL) = XLCF                                                         HY 11000
      TPI(IWL) =AIWP3(IWL)/420.0                                                HY 11100
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      IF(ABS(VOL)-0.0001) 9400,9400,9408                                    MY 11200
 9400 WMT(IWL)=0.0                                                          MY 11300
      BML(IWL)=0.0                                                          MY 11400
      GO TO 601                                                             MY 11500
 9408 BMT(IWL) = XIIT      /VOL3(IWL)                                       MY 11600
      BML(IWL) = XIIL      /VOL3(IWL)                                       MY 11700
      IF (ABS(BML(IWL))- .0001) 600,600,601                                 MY 11800
  601 XKML(IWL) = BML(IWL) * XKR3(IWL)                                      MY 11900
      XKMT(IWL) = BMT(IWL) * XKR3(IWL)                                      MY 12000
      GO TO 608                                                             MY 12100
  600 XKML(IWL) = 0.0                                                       MY 12200
      XKMT(IWL) = 0.0                                                       MY 12300
  608 CIDOPT(IWL) = -12.0*TPI(IWL)*XLCP3(IWL)/XLBP                          MY 12400
      XMTI(IWL) =DISPL3(IWL)*BML(IWL)/(2.0*XLBP)                            MY 12500
      IF(ICAT-2) 8422,8423,8423                                             MY 12600
 8423 CIP(IWL)=0.                                                           MY 12700
      CIALPH(IWL)=0.                                                        MY 12800
      CIWP(IWL)=0.                                                          MY 12900
      GO TO 10                                                              MY 13000
 8422 CIP(IWL)=VOL3(IWL)/(AIMA*XLBP)                                        MY 13100
      CIWP(IWL) =AIWP3(IWL)/(XLBP*YIMA**2.0)                                MY 13200
   10 CIALPH(IWL)=XIIT/(0.0667*XLBP*YIMA***3)                               MY 13300
      WRITE (6,806)(NAME(I), I = 1,8),ISERNO,(DATE(I), I = 1,2)             MY 13400
      WRITE (6,807)                                                         MY 13500
  807 FORMAT(1H1,4HNOTE - ALL PRISMATIC, WPLANE, AND WPLANEI COEFFICIENTSMY 13600
     1 ARE BASED ON THE AREA AND BEAM AT THE DWL OF THE STATION  /       MY 13700
     2 8TH OF MAXIMUM AREA AT THE DWL/)                                 MY 13800
      WRITE(6,800) TRIM3(ITRIM),THET3M(ITHEEL),                         MY 13900
     1                          (DWL(I), WIOUT(I),VOL3(I),DISPL3(I),XLCMY 14000
     1B3(I),XKR3(I),Q3SHIP(I),CIP(I),CIWP(I),CIALPH(I), I=1,NWL)        MY 14100
      WRITE(6,801) TRIM3(ITRIM),THET3M(ITHEEL),                         MY 14200
     1                          (DWL(I), WIOUT(I), AIWP3(I),XLCP3(I),TPMY 14300
     1I(I),CIDOPT(I),BML(I), BMT(I),XKML(I),XKMT(I),XMTI(I), I=1,NWL)   MY 14400
      WRITE(6,806) NAME,ISERNO,DATE                                     MY 14500
      DO 9648 IWL = 1,NWL                                               MY 14600
 9648 WRITE(6,9649) WIOUT(IWL),TCB3(IWL),RA3(IWL)                       MY 14700
 9649 FORMAT(*   DRAFT        TCB    RIGHT ARM*/(3F10.2))               MY 14800
  300 CONTINUE                                                          MY 14900
      ILIMT = LIMIT                                                     MY 15000
      LIMIT = 10                                                        MY 15100
      INIT = 1                                                          MY 15200
  850 WRITE (6,806)(NAME(I), I = 1,8),ISERNO, (DATE(I), I = 1,2)        MY 15300
  858 NPART = LIMIT/10                                                  MY 15400
      WRITE (6,860)NPART                                                MY 15500
      IF(NSTAT-LIMIT)840,840,870                                        MY 15600
  840 LIMIT = NSTAT                                                     MY 15700
  870 WRITE (6,880)(STATNO(J), J = INIT,LIMIT)                          MY 15800
      WRITE (6,882)                                                     MY 15900
      DO 880 IWL = 1,NWL                                                MY 16000
  880 WRITE (6,881)DWL(IWL),WIOUT(IWL),(AREA3(IWL,ISTAT),ISTAT=INIT,LIMMY 16100
     1IT)                                                               MY 16200
  881 FORMAT(A6,F7.2,10(3X,F7.1))                                       MY 16300
      IF(NSTAT-LIMIT)890,890,894                                        MY 16400
  894 INIT = INIT+10                                                    MY 16500
      LIMIT = LIMIT + 10                                                MY 16600
      IF(INIT-81)850,850,850                                            MY 16700
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      LIMIT = ILIMT                                                          HY 16800
      RETURN                                                                 HY 16900
  846 FORMAT(4H1,5HSHIP-,4A6,5X,6HSERIAL NUMBER-,I4,5X,9HDUATE-,2A6/)        HY 17000
  849 FORMAT(//36H SECTIONAL AREAS IN SQUARE FEET-PART,I2)                   HY 17100
  850 FORMAT(6X,                                                             HY 17200
     1       8H STATION,10(3XF7.2))                                          HY 17300
  852 FORMAT(6X,6H DRAFT)                                                    HY 17400
  900 FORMAT(31HOHYDROSTATICS - PART I ---TRIM=F8.3,1H)1HFT----HEEL=F8.3HY 17500
     1,1X7HDEGREES/1H0,6X                                                    HY 17600
     1                                        8HDRAFT,8X6HVOLUME,3X,8HDISPLACHY 17700
     2EMENT,3X,5HLCB,7X,5HKB&X,6HWETTED SURFACE,4X6HBRISMATIC,3X,11HWPLANE COEFHY 17800
     3,3X,5HWPLANE I COEF/                                                   HY 17900
     4(1A6,       F8.4,8X,F9.0,4X,F8.1,3X,F7.4,3X,F8.2,8X,F10.0,HY 18000
     8X,F8.3,8X,F8.3,11X,F8.3 ))                                             HY 18100
  80( FORMAT(//32HOHYDROSTATICS - PART II ---TRIM=F8.3,1X)1HFT----HEEL=FHY 18200
     18.3,1X7HDEGREES/1H0,6X                                                 HY 18300
     1                                        8HDRAFT,6X)1HWPLANE AREA,3X,5HLCHY 18400
     2F,7X,5HTPI,6X,7HCIRCF,7X,5HLONG. ,5H3X,8HTRANSV ,4H3X,8HLONG. ,4H3X,8HTRANSV 4HY 18500
     3H,3X,3HMT)/                                                            HY 18600
     4(1A6,       F8.2,8X,F8.0,3X,F7.2,3X,F7.2,   F8.2,4X,F8.2,3X,F7.2,4X,HY 18700
     8F8.2,3X,F7.2,3X,F7.1 ))                                                HY 18800
      END                                                                    HY 18900
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      IF(ABS(VOL)-0.0001) 9400,9400,9408                                    MY 11200
 9400 WMT(IWL)=0.0                                                          MY 11300
      WML(IWL)=0.0                                                          MY 11400
      GO TO 801                                                             MY 11500
 9408 WMT(IWL) = XIIT      /VOL3(IWL)                                       MY 11600
      WML(IWL) = XIIL      /VOL3(IWL)                                       MY 11700
      IF (ABS(WML(IWL))- .00001) 800,800,801                                MY 11800
  801 XKML(IWL) = WML(IWL) * AKR3(IWL)                                      MY 11900
      XKMT(IWL) = WMT(IWL) * AKR3(IWL)                                      MY 12000
      GO TO 802                                                             MY 12100
  800 XKML(IWL) = 0.0                                                       MY 12200
      XKMT(IWL) = 0.0                                                       MY 12300
  802 CIDOPT(IWL) = -12.0*TPI(IWL)*XLCP3(IWL)/XLBP                          MY 12400
      XMTI(IWL) =DISPL3(IWL)*WML(IWL)/(2.0*XLBP)                            MY 12500
      IF(ICAT-2) 8402,8403,8403                                             MY 12600
 8403 CIP(IWL)=0.                                                           MY 12700
      CIALPH(IWL)=0.                                                        MY 12800
      CIWP(IWL)=0.                                                          MY 12900
      GO TO 10                                                              MY 13000
 8402 CIP(IWL)=VOL3(IWL)/(AIMA*XLBP)                                        MY 13100
      CIWP(IWL) =AIWP3(IWL)/(ALMP**2*AIMA**2.0)                             MY 13200
   10 CIALPH(IWL)=XIIT/(0.666*XLBP*AIMA**3)                                 MY 13300
      WRITE (6,806)(NAME(I), I = 1,8),ISERNO,(DATE(I), I = 1,2)             MY 13400
      WRITE (6,807)                                                         MY 13500
  807 FORMAT(1H1,40HNOTE - ALL PRISMATIC, WPLANE, AND WPLANEI COEFFICIENTSMY 13600
     1 ARE BASED ON THE AREA AND BEAM AT THE DWL OF THE STATION  /          MY 13700
     2 87H OF MAXIMUM AREA AT THE DWL/)                                     MY 13800
      WRITE(6,800) TRIM3(ITRIM),THETBM(ITHEEL),                             MY 13900
     1                          (DWL(I), HIOUT(I),VOL3(I),DISPL3(I),XLCMY 14000
     1B3(I),XKR3(I),Q3BHIP(I),CIP(I),CIWP(I),CIALPH(I), I=1,NWL)            MY 14100
      WRITE(6,801) TRIM3(ITRIM),THETBM(ITHEEL),                             MY 14200
     1                          (DWL(I), HIOUT(I), AIWP3(I),XLCP3(I),TPMY 14300
     1I(I),CIDOPT(I),BML(I), BMT(I),XKML(I),XKMT(I),XMTI(I), I=1,NWL)       MY 14400
      WRITE(6,806) NAME,ISERNO,DATE                                         MY 14500
      DO 9648 IWL = 1,NWL                                                   MY 14600
 9648 WRITE(6,9649) HIOUT(IWL),TCB3(IWL),RA3(IWL)                           MY 14700
 9649 FORMAT(*   DRAFT       TCR    RIGHT ARM*/(3F10.2))                    MY 14800
  800 CONTINUE                                                              MY 14900
      ILIM = LIMIT                                                          MY 15000
      LIMIT = 10                                                            MY 15100
      INIT = 1                                                              MY 15200
  810 WRITE (6,806)(NAME(I), I = 1,8),ISERNO, (DATE(I), I = 1,2)            MY 15300
  808 NPART = LIMIT/10                                                      MY 15400
      WRITE (6,849)NPART                                                    MY 15500
      IF(NSTAT-LIMIT)840,840,870                                            MY 15600
  840 LIMIT = NSTAT                                                         MY 15700
  870 WRITE (6,850)(STATNO(J), J = INIT,LIMIT)                              MY 15800
      WRITE (6,852)                                                         MY 15900
      DO 880 IWL = 1,NWL                                                    MY 16000
  880 WRITE (6,851)DWL(IWL),HIOUT(IWL),(AREA48(IWL,ISTAT),ISTAT=INIT,LIMMY 16100
     1IT)                                                                   MY 16200
  851 FORMAT(A6,F7.2,10(3X,F7.1))                                           MY 16300
      IF(NSTAT-LIMIT)890,890,884                                            MY 16400
  884 INIT = INIT+10                                                        MY 16500
      LIMIT = LIMIT + 10                                                    MY 16600
      IF(INIT-81)858,858,858                                                MY 16700
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      LIMIT = ILIMT                                                          HY 16800
      RETURN                                                                 HY 16900
  846 FORMAT(4H1,8HSHIP ,4A6,8X,16HSERIAL NUMBER=,I4,8X,8HDATE=,2A6/)        HY 17000
  849 FORMAT(/,36H SECTIONAL AREAS IN SQUARE FEET-PART,I2)                   HY 17100
  850 FORMAT(6X,                                                             HY 17200
     1       8H STATION,10(3XF7.2))                                          HY 17300
  854 FORMAT(6X,6H DRAFT)                                                    HY 17400
  860 FORMAT(31H0HYDROSTATICS - PART I ---,7H,M=,F8.3,1X,1H,,1HFT----,4HEEL=,F8.3HY 17500
     1,1X,7HDEGREES/1H0,8X                                                   HY 17600
     1                                    8H0DRAFT,8X,6HVOLUME,3X,12HDISPLACHY 17700
     2EMENT,3X,3HLCB,7X,2HKB,8X,16HWETTED SURFACE,3X,8HPRISMATIC,3X,1H,,4HMPLANE COEFHY 17800
     3,3X,1HWPLANE I COEF/                                                   HY 17900
     4(1A6,                F8.2,8X,F8.0,4X,F8.1,3X,F7.2,3X,F8.2,8X,F10.0,4HY 18000
     5X,F8.2,8X,F8.3,11X,F8.3 ))                                             HY 18100
  861 FORMAT(//,31H0HYDROSTATICS - PART II ---,7H,M=,F8.3,1X,1H,,4HFT----,4HEEL=,FHY 18200
     18.3,1X,7HDEGREES/1H0,8X                                                HY 18300
     1                                    8HDRAFT,6X,11HMPLANE AREA,3X,3HLCHY 18400
     2F,7X,3HTPI,6X,7HCIMOFT,3X,8HLONG. ,8H,3X,8HTRANSV ,8H,3X,8HLONG. , KMHY 18500
     3H8X,3HMTI/                                                             HY 18600
     4(1A6,       F8.2,8X,F8.0,3X,F7.2,2X,F7.2,   F8.2,8X,F8.2,3X,F7.2,4X,4HT;8700
     5F8.2,3X,F7.2,3X,F7.1 ))                                                HY 18800
      END                                                                    HY 18900
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      SUBROUTINE INTACT                                                 IN    200
      DIMENSION HB(8,8,10),TRIMB(8,8,10)                                IN    300
      DIMENSIONA(WP3(20),AREA1B(60,20),AREAPB(60),AREA4B(20,30),BML(20),DI  400
     1BMT(20),CIALPH(20),CLP(20),CLWP(20),CLNOFT(20),DATE(2),DISPL3(20),DI  500
     1DWL(20),H(60),HICOMP(20),HIHOB(60),HIMAH(60),HIOUT(20),HISAB(60),HDI  600
     1RCOMP(20),ICOMP(2),JMREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI  700
     1AME1B(8),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                   DI  800
      DIMENSIONPERM2(10),RAB(8,8,10),S(60,20),SPB(60),S3BHIP(20),STATNO(DI  900
     160),SECTIM(20),TCA1C(20),TCBB(8,8,10),TCB1B(60,20),TCBPB(60),THETBDI 1000
     2(0),TPI(20),TRIM3(6),VCA1C(20),VCBB(8,8,10),VCB1B(60,20),VCBPB(6DI 1100
     3,VOL3(20),VOL8(8),VOL1C(20),WEIGHT(20),X(60),XIDAM(30),XIDAMB(10DI 1200
     4,XIDAM8(20),XRDAM8(20),XIW(20),XRDAM(30),XRDAMB(10)               DI 1300
      DIMENSIONXPB(60),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCB1C(20DI 1400
     1),XLCB3(20),XLCP3(20),XLCB1W(20),XLCBB(8),XMTI(20),Y(60,20),Y1(60)DI 1500
     1,Z(60,20),YLINT(4,30),THETBM(8)                                   DI 1600
      DIMENSION XLVM(20)                                                DI 1700
      COMMON/1/AIMA,AIWP,AIWP3,AREA1B,AREAPB,AREA4B,BML,BMT,CIA,CIALPH,CDI 1800
     1LB,CLC,CLP,CLDOFT,CLWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI 1900
     1,HICOMP,HIHOB,HIMAH,HIOUT,HISAB,HMMAH,HMMAH,HOMAH,HW,IIAFT,IIBAL,DI 2000
     1IIPWB,IISYM,IIWC,IIWM,IIWL,IBWC,IBWM,IBWL,IBREAK,ICOMP,ICHEKB,INITDI 2100
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IV,JBREAK                DI 2200
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIWEEL,NILCBDI 2300
     1,NIPERM,NITRIM,NAME,NAMEIB,NCOMPI,NCOMPP,NNSTAT,NP,NSTAT,NSTAT1,NSDI 2400
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,S3BHIP,SPB,S3BHIDI 2500
     1P,SPACE,STATNO,SECTIM,TCB,TCA1C,TCBB,TCB1B,TCBPB,THETIM,THETIT,THEDI 2600
     1TBT,THETBM,TPI,TRIM3,VCB1C,VCBB,VCB1B,VCBPB,VOL                   DI 2700
      COMMON/3/VOL1C,VOL1D,VOL3,VOL8,WAVCPN,WCIINC,WEIGHT,WWIINC,WWIMUL,DI 2800
     1WLIINC,X,XIDAM,XIDAM8,XILIM,XIM,XIW,XRDAM,XRDAM8,XRLIM,XRB,XJLIM,XDI 2900
     1ALIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCB1C,XLCB3,XLDI 3000
     1CP,XLCP3,XLCB,XLCB1W,XLCBB,XLMAIR,XLMADA,XMID,XMOMIL,XMOM3V,XMTI,YDI 3100
     1,Y1,YIMA,Z,WAVLOC ,XIDAM8,XRDAM8,XLMBPR,IGBAL                     DI 3200
      COMMON/4/ICAT,YLINT,NSHEEL,THETBM,LIMIT                           DI 3300
      KVOL=1                                                            IN 3400
      IPRINT = 7                                                        IN 3500
      IIBAL=1                                                           IN 3600
      WRITE(6,806) (NAME(IJ),IJ=1,8),ISERNO,(DATE(IJ),IJ=1,2)           IN 3700
      WRITE(6,700)                                                      IN 3800
      VOL0D=VOL1D                                                       IN 3900
      DO 400   L=1,NIMPEL                                               IN 4000
  400 THETBM(L)=THETBM(L)*.01745329                                     IN 4100
      DO 100 I=1,NIUSPL                                                 IN 4200
      VOLB(I)=VOLB(I)*35.0                                              IN 4300
      DO 100 J=1,NILCB                                                  IN 4400
      DO 100 L=1,NIMPEL                                                 IN 4500
      VOL1D=VOLB(I)                                                     IN 4600
      XLCB=XLCBB(J)                                                     IN 4700
      THETIM=THETBM(L)                                                  IN 4800
      CALL BAL                                                          IN 4900
      IF (IIBAL - 8) 301, 300, 301                                      IN 5000
  300 IIBAL = 1                                                         IN 5100
      YCB = 0.0                                                         IN 5200
      XKB = 0.0                                                         IN 5300
      THETIM = THETIM * 57.2958                                         IN 5400
      THETIT = THETIT * 57.2958                                         IN 5500
      VOL1D = VOL1D/35.0                                                IN 5600
      WRITE(6,806) (NAME(IJ),IJ=1,8),ISERNO,(DATE(IJ),IJ=1,2)           IN 5700
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      WRITE(6,600)                                                          IN  6700
      WRITE (6,302)THETIN, THETIT, VOLID                                    IN  6800
  102 FORMAT(30H SHIP WILL NOT BALANCE UNDER FOLLOWING CONDITIONS ,// 18HIN  6900
     1 HEEL ANGLE ,F6.2,9H DEGREES ,5X,12H TRIM ANGLE ,F6.2,9H DEGREES ,IN  7000
     2 5X,14H DISPLACEMENT ,F11.3,6H TONS )                             IN  7100
  101 TCBB(I,J,L) = TCB                                                 IN  7200
      VCBB(I,J,L)=XKB                                                   IN  7300
       HB(I,J,L) = H(NABC                                               IN  7400
      TRIMB(I,J,L) = H(I)AFT)-H(I)FWD)                                  IN  7500
  100 HAB(I,J,L)=TCB/COS(THETIH)+XKB*SIN(THETIH)                        IN  7600
     1-TCB*SIN(THETIH)**2/COS(THETIH)                                   IN  7700
      DO 500   L=1,NWHEEL                                              IN  7800
  500 THETBH(L)=THETBH(L)/.01745329                                     IN  7900
      WRITE(6,600) (NAME(I3),I3=1,8),ISERNO,(DATE(I3),I3=1,2)           IN  8000
      WRITE(6,600)                                                      IN  8100
      WRITE (6,101)                                                     IN  8200
      DO 200 I=1,NIDSPL                                                 IN  8300
      VOLB(I)=VOLB(I)/35.0                                              IN  8400
      DO 200 J=1,NILPO                                                  IN  8500
       DO 200 L=1,NWHEEL                                                IN  8600
      IPRINT = IPRINT + 1                                               IN  8700
      WRITE (6,102)VOLB(I), XLCOB(J), THETBH(L), TCBB(I,J,L), VCBB(I,J,LIN  8800
     1), HAB(I,J,L) ,HB(I,J,L),TRIMB(I,J,L)                             IN  8900
      IF(IPRINT-55) 200,709,709                                         IN  9000
  709 IPRINT = 7                                                        IN  9100
      WRITE(6,800) (NAME(I3),I3=1,8),ISERNO,(DATE(I3),I3=1,2)           IN  9200
      WRITE(6,600)                                                      IN  9300
      WRITE(6,101)                                                      IN  9400
  200 CONTINUE                                                          IN  9500
  101 FORMAT(14X,5HDISPL,6X,10HINPUT TRIM,9X,4HHEEL,9X,3HTCB,10X,3HVCB,11X, IN  9600
     12HHAB,8X,5HDRAFT,8X,10HFINAL TRIM)                                IN  9700
  102 FORMAT(10X,8(F10.3,3X)/)                                          IN  9800
      VOLID=VOLDU                                                       IN  9900
       THETIH = 0.0                                                     IN 10000
  600 FORMAT(30X,30H,20H INTACT CROSS CURVES//)                         IN 10100
  700 FORMAT(75H THE FOLLOWING PAGES CONTAIN THE RESULTS OF INTACT CROSSIN 10200
     1 CURVE CALCULATIONS///12H DEFINITIONS//30H DISPL- INPUT DISPLACEMEIN 10300
     2NT IN TONS/19H INPUT TRIM IN FEET/22H HEEL ANGLE IN DEGREES/30H TCIN 10400
     3H-TRNSV CB FROM CL IN FT     /22H VCB- VERT CB ABV BL IN FT    /  IN 10500
     422H RA- RIGHTING ARM IN FT /30H DRAFT- DRAFT AMIDSHIPS IN FT  /   IN 10600
     517H FINAL TRIM IN FT )                                            IN 10700
  800 FORMAT(6H1SHIP-,A8,6X,14HSERIAL NUMBER-I6,5X,5HDATE-2A6/)         IN 10800
      RETURN                                                            IN 10900
      END                                                               IN 11000
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      SUBROUTINE TEST1(TEST,ARRAY)                                          TE   200
C                                                                           TE   300
      DIMENSION ARRAY(60,29)                                                TE   400
      DIMENSIONAIWP3(20),AREAIS(60,29),AREAPS(60),AREA4S(20,30),BML(20),DI  TE   500
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI  TE   600
     1DWL(20),H(60),HICOMP(20),HIMCO(60),HIMAR(60),HIOUT(60),HISAO(60),HDI  TE   700
     1PCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI  TE   800
     1AMEIS(8),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                       DI   TE   900
      DIMENSIONPERM2(10),RAS(5,5,10),S(60,29),SPS(60),SISHIP(20),STATNO(DI  TE  1000
     160),SECTIM(25),TCRIC(25),TCRS(5,5,10),TCGIS(60,29),TCGPS(60),THETSDI  TE  1100
     1M(10),TPI(20),TRIM3(6),VCRIC(25),VCRS(5,5,10),VCGIS(60,29),VCGPS(6DI  TE  1200
     10),VOL3(20),VOLS(5),VOLIC(25),WEIGHT(25),X(60),XIDAM(30),XIDAMP(15DI  TE  1300
     1),XIDAMS(20),XPDAMS(20),XIW(25),XPDAM(30),XPDAMS(10)                  DI   TE  1400
      DIMENSIONXRS(60),XRS3(20),XRML(20),XRMT(20),XLIDAM(10,3),XLCBIC(25DI  TE  1500
     1),XLCB3(20),XLCF3(20),XLCGIW(25),XLCGS(5),XMTI(20),Y(60,29),YI(60)DI  TE  1600
     1,Z(60,29),YIINT(4,10),THETJM(4)                                       DI   TE  1700
      DIMENSION ALVR(29)                                                    DI   TE  1800
      COMMON/1/AIMA,AIWP,AIWP3,AREAIS,AREAPS,AREA4S,BML,BMT,CIA,CIALPH,CDI  TE  1900
     11R,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  TE  2000
     1,HSCOMP,HIMOO,HIMAR,HIOUT,HISAO,HSMAR,HSMAR,HSMAR,HWI,IIART,IIBAL,DI  TE  2100
     1IIPWD,IISYM,ITWC,IIWM,IIWL,IPWC,IPWM,IPWL,IBREAK,ICOMP,ICHERK,INITDI  TE  2200
     1,ISENTI,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                    DI   TE  2300
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHEEL,NILCGDI  TE  2400
     1,NIPERM,NITRIM,NAME,NAMEIS,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  TE  2500
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAS,S,SISHIP,SPS,SSSHIDI  TE  2600
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRS,TCGIS,TCGPS,THETIM,THETIT,THEDI  TE  2700
     1TBT,THETSM,TPI,TRIM3,VCRIC,VCRS,VCGIS,VCGPS,VOL                       DI   TE  2800
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCEN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  TE  2900
     1WLIINC,X,XIDAM,XIDAMS,XILIM,XIM,XIW,XPDAM,XPDAMS,XRLIM,XRS,XSLIM,XDI  TE  3000
     1SLIM,XIIL,XIIT,XMR,XRR3,XRML,XRMT,XLIDAM,XLBP,XLCR,XLCBIC,XLCR3,XLDI  TE  3100
     1CF,XLCF3,XLCG,XLCGIW,XLCGS,XLMRIR,XLMRDA,XMID,XMOMII,XMOMMV,XMTI,YDI  TE  3200
     1,YI,YIMA,Z,WAVLOC ,XIDAMS,XPDAMS,XLMRPR,IBAL                          DI   TE  3300
      COMMON/4/ICAT,YIINT,NJHEEL,THETJM,LIMIT                               DI   TE  3400
C     LOGIC SECTIONS REFER TO PROGRAM WRITEUP                               TE   3500
C                                                                           TE   3600
C                                    LOGIC SECTION 1                        TE   3700
      IF(TEST-ARRAY(ISTAT,M))8,8,6                                          TE   3800
C                                    LOGIC SECTION 2                        TE   3900
    8 DO 10 IWP = 1,M                                                       TE   4000
      NWP= M-IWP+1                                                          TE   4100
      IF(ABS(ARRAY(ISTAT,NWP)-TEST)-.000001) 10,10,400                      TE   4200
  400 IF(ARRAY(ISTAT,NWP)-TEST)20,10,10                                     TE   4300
   10 CONTINUE                                                              TE   4400
C                                    LOGIC SECTION 3                        TE   4500
      K = 4                                                                 TE   4600
      GO TO 30                                                              TE   4700
C                                    LOGIC SECTION 4                        TE   4800
   15 K=2                                                                   TE   4900
      GO TO 30                                                              TE   5000
C                                    LOGIC SECTION 5                        TE   5100
   20 K=3                                                                   TE   5200
      GO TO 30                                                              TE   5300
C                                    LOGIC SECTION 6                        TE   5400
    6 K=1                                                                   TE   5500
   30 RETURN                                                                TE   5600
      END
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      SUBROUTINE TEST2                                                  TE   200
      DIMENSION AWP2(20),AREA1S(60,29),AREAPS(60),AREAOR(20,30),AML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL2(20),DI   400
     1DWL(20),H(60),HICOMP(20),HIHOO(60),HIMAR(60),HIOUT(20),HISAO(60),HDI   500
     1ECOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   600
     1AME1S(8),NCOMP2(2,3,3),NP(60),PERM1(18),PERM1(3)                  DI   650
      DIMENSION PERMP(18),RAB(5,5,10),S(60,29),SPS(60),S2SHIP(20),STATNO(DI   700
     160),SECTIM(25),TCRIC(20),TCRB(5,5,10),TCQ1S(60,29),TCQRS(60),THETSDI   800
     1M(10),TPI(20),TRIM2(6),VCRIC(20),VCRB(5,5,10),VCQ1S(60,29),VCQRS(6DI   900
     10),VOL2(20),VOLS(6),VOLIC(20),WEIGHT(20),X(60),XIDAM(10),XIDAMP(1ODI  1000
     1),XIDAM6(20),XJDAM6(20),XIW(20),XJDAM(10),XRDAMP(10)              DI  1100
      DIMENSION XAPS(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(10,3),XLCBIC(20DI  1200
     1),XLCB3(20),XLCP3(20),XLCQIW(20),XLCQS(6),XMTI(20),Y(60,29),YI(60)DI  1300
     1,Z(60,20) ,YIINT(6,30),THETSM(6)                                  DI  1400
      DIMENSION XLVM(20)                                                DI  1490
      COMMON/1/AIMA,AIWP,AIWP3,AREA1S,AREAPS,AREAOR,AML,AMT,CIA,CIALPH,CDI  1500
     11B,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HISABC,HICOMPDI  1600
     1,HSCOMP,HIHOO,HIMAR,HIOUT,HISAO,HPMAR,HSMAR,HSMAR,HWI,IIAFT,IIBAL,DI  1700
     1IIFWD,IISYM,IIWC,IIWM,IIWL,ISWC,IPWM,IPWL,IBREAK,ICOMP,ICHECK,INITDI  1800
     1,ISENTI,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  1900
      COMMON/P/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NTRUTT,NIOSPL,NIMEEL,NILCBDI  2000
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2100
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,S1SHIP,SPS,S1SHIDI  2200
     1P,SPACE,STATNO,SECTIM,TCB,TCBIC,TCBS,TCQ1S,TCQRS,THETIM,THETIT,THEDI  2300
     1TAT,THETSM,TPI,TRIM2,VCB1S,VCBS,VCQ1S,VCQRS,VOL                   DI  2400
      COMMON/3/VOLIC,VOLID,VOL3,VOL6,WAVCEN,WCIINC,WEIGHT,WWIINC,WWIMUL,DI  2500
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XRDAM,XRDAM2,XRLIM,XRS,XJLIM,XDI  2600
     1OLIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCBIC,XLCB3,XLDI  2700
     1CP,XLCP3,XLCQ,XLCQIW,XLCQS,XLMBIR,XLMBDA,XMID,XMOMII,XMOMJV,XMTI,YDI  2800
     1,YI,YIMA,Z,WAVLOC ,XIDAM6,XJDAM6,XLMBPR,IABAL                     DI  2900
      COMMON/S/ICAT,YIINT,NSHEEL,THETSM,LIMIT                           DI  3000
      IF(X(ISTAT) .EQ. X(ISTAT+1)) ISTAT=ISTAT+1                        TE  3200
      SPACE=(XRS(ISTAT+1)-XRS(ISTAT))/2.                                TE  3300
      IF(ISTAT .EQ. NSTAT2) GO TO 8                                     TE  3400
      IF(X(ISTAT+1) .EQ. X(ISTAT+2)) 8.50                               TE  3500
    8 IF(ISTAT.EQ. NSTAT1) GO TO 30                                     TE  3600
   10 IF(X(ISTAT).EQ. X(ISTAT-1)) GO TO 50                              TE  3700
   18 X1=XRS(ISTAT-1)                                                   TE  3800
      X2=XRS(ISTAT)                                                     TE  3900
      X3=XRS(ISTAT+1)                                                   TE  4000
      X1M= X2 + SPACE                                                   TE  4100
      M=ISTAT+1                                                         TE  4200
      K=1                                                               TE  4300
   [0 CALL COEF11(X1,X2,X3,X1M)                                         TE  4400
      RETURN                                                            TE  4500
   20 IF(ABS(XRS(ISTAT+2)-XRS(ISTAT)-2.0*XRS(ISTAT+1))-1.0)25,25,30     TE  4600
   25 X1M=XRS(ISTAT+1)                                                  TE  4700
      SPACE=XRS(ISTAT+1)-XRS(ISTAT)                                     TE  4800
      M=ISTAT+2                                                         TE  4900
      K=2                                                               TE  5000
      RETURN                                                            TE  5100
   30 SPACE=(XRS(ISTAT+2)-XRS(ISTAT))/2.0                               TE  5200
      X1M= XRS(ISTAT) +SPACE                                            TE  5300
      M=ISTAT+2                                                         TE  5400
      K=1                                                               TE  5500
      X1= XRS(ISTAT)                                                    TE  5600
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      XE= XBS(ISTAT,5)                                          YE  5700
      XJ= XBS(ISTAT,6)                                          YE  5800
      GO TO 18                                                  YE  5900
   90 XIM= XBS(ISTAT) * SPACE                                   YE  6000
      K=9                                                       YE  6100
      RETURN                                                    YE  6200
      END                                                       YE  6300
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      SUBROUTINE TEST9(ITEST,ARRAY)                                          TE   200
      DIMENSION ARRAY(2,20)                                                  TE   300
      DIMENSIONAIWP3(20),AREA1B(60,20),AREA2B(60),AREA4B(20,30),BML(20),DI   400
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(9),DISPL3(20),DI   500
     1DWL(20),H(60),HICOMP(20),HIMOD(60),HIMAR(60),HIOUT(20),HISAB(60),HDI   600
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   700
     1AME1B(8),NCOMPB(2,3,3),NP(60),PERM(18),PERM1(3)                       DI   800
      DIMENSIONPERMB(18),RAB(6,6,10),B(60,20),BPB(60),B3BMIP(20),BTATNO(DI   900
     160),BECTIM(20),TCAIC(20),TCAB(6,6,10),TCO1B(60,20),TCOPB(60),THETBDI  1000
     1M(10),TPI(20),THIMJ(6),VCAIC(20),VCAB(6,6,10),VCO1B(60,20),VCOPB(6DI  1100
     10),VOL3(20),VOL.B(6),VOLIC(20),WEIGHT(20),X(60),XIDAM2(30),XIDAMB(18DI  1200
     11),XIDAMB(20),XPDAMB(20),XIW(20),XPDAM(30),XPDAMB(18)                 DI  1300
      DIMENSIONXPB(60),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCBIC(20DI  1400
     1),XLCB3(20),XLCP1(20),XLCP1W(20),XLCP1W(20),XMTI(20),Y(60,20),YI(60)DI  1500
     1,Z 60,20) ,YIINT(4,30),IMETBM(8)                                      DI  1600
      DIMENSION XLVR(20)                                                     DI  1700
      COMMON/1/AIMA,AIWP,AIWP3,AREA1B,AREA2B,AREA4B,BML,BMT,CIA,CIALPH,CDI   1800
     1IB,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIMABC,HICOMPDI  1900
     1,HICOMP,HIMOD,HIMAR,HIOUT,HISAB,HJMAR,HKMAR,HWI,IIAPT,IIBAL,DI   2000
     1IIFWD,IIBYM,IIWC,IIWH,IIWL,I2WC,IPWH,IPWL,IBREAK,ICOMP,ICHECK9,INITDI  2100
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                    DI  2200
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KWC,KWH,NAUTT,NIDSPL,NIMEEL,NILCSDI  2300
     1,NIPERM,NITRIM,NAME,NAME1B,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2400
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,B,B1BHIP,BPB,B3BMIDI  2500
     1P,SPACE,STATNO,SECTIM,TCB,TCB1C,TCBB,TCO1B,TCOPB,THETIM,THETIT,THEDI  2600
     1TBT,THETBM,TPI,THIMJ,VCB1C,VCBB,VCO1B,VCOPB,VOL                       DI  2700
      COMMON/3/VOL1C,VOL1D,VOL3,VOLB,WAYCFN,WC1INC,WEIGHT,WH1INC,WH1MUL,DI   2800
     1WL1INC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAMB,XPLIM,XPB,XPLIM,XDI  2900
     1KLIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCB1C,XLCB3,XLDI  3000
     1CP,XLCP3,XLCQ,XLCQ1W,XLCQB,XLMBIM,XLMBDA,XMID,XMOM11,XMOM3V,XMTI,YDI  3100
     1Y1,YIMA,Z,WAV1OC ,XIDAMB,XPDAMB,XLMBPR,IBRAL                          DI  3200
      COMMON/4/ICAT,YIINT,NBMEEL,IMETBM,LIMIT                                DI  3300
      DIMENSION  XIB(30),YIB(30,20),ZIB(30,20),YIBT(2,20),ZIBT(2,20),      DI   100
     1ZINT(4,10),YINT(4,10),XBLK(4),NINT(4),NPIB(30),JBPIB(30,10),          DI   200
     2JBPBT(2,10),NPIBT(2)                                                  DI   300
      COMMON XIB,YIB,ZIB,XBLK,YINT,ZINT,NPIB,NINT,YIBT,ZIBT,NPIBT,JBPIB,DI   400
     1JBPBT,INDX3,JBTAT,NBTAT,LBTAT,MBTAT,NBILK,LBULK,JCAT                  DI   500
    1 NPT = NPIBT(INDX3)                                                    TE   600
      DO 40 IWP = 1,NPT                                                     TE   700
      NWP = NPT-IWP+1                                                       TE   800
      IF(ABS(ARRAY(INDX3,NWP)-TEST)-.1)10,10,5                              TE   900
    5 IF(ARRAY(INDX3,NWP)-TEST)20,10,40                                     TE  1000
   10 K=2                                                                   TE  1100
      RETURN                                                                TE  1200
   20 K=3                                                                   TE  1300
      RETURN                                                                TE  1400
   40 CONTINUE                                                              TE  1500
      K=1                                                                   TE  1600
      RETURN                                                                TE  1700
      END                                                                   TE  1800
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      SUBROUTINE VOLUME                                                 VO   800
      DIMENSION AREA1S(2),VCOJS(2),TCOJS(2)                             VO   300
      DIMENSION AREAMS(3),VCOMS(3),TCOMS(3),HBS(3)                      VO   400
      DIMENSIONAIWP3(20),AREA1S(60,20),AREAPS(60),AREAMS(20,30),AML(20),DI   800
     1BMT(20),CIALPM(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   300
     1DWL(20),H(60),HICOMP(20),HIMOD(60),HIMAR(60),HIOUT(20),HIBAS(60),HDI   400
     1RCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   500
     1AME1S(8),NCOMPS(2,3,3),NP(60),PERM(18),PERM1(3)                   DI   600
      DIMENSIONPERM2(18),RAB(5,5,10),S(60,20),SBS(60),SIGHIP(20),STATNO(DI   700
     160),SECTIM(20),TCBIC(20),TCBS(5,5,10),TCOIS(60,20),TCOSS(60),THETSDI   800
     1M(10),TPI(20),TRIM3(6),VCBIC(20),VCBS(5,5,10),VCOIS(60,20),VCOSS(6DI   900
     10),VOL3(20),VOIS(8),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAM2(10DI  1000
     1),XIDAMS(20),XPDAMS(20),XIW(20),XPDAM(30),XPDAM2(10)              DI  1100
      DIMENSIONXPS(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCBIC(20DI  1200
     1),XLCM3(20),XLCPIC(20),XLCWIW(20),XLCOS(8),XMTI(20),Y(60,20),YI(60)DI  1300
     1,Z(60,20),YINT(6,30),THETJM(8)                                    DI  1400
      DIMENSION XLVR(20)                                                DI  1490
      COMMON/1/AIMA,AIWP,AIWP3,AREAIS,AREAPS,AREAMS,BML,BMT,CIA,CIALPM,CDI  1500
     1IB,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  1600
     1,HICOMP,HIMOD,HIMAR,HIOUT,HIBAS,HJMAR,HJMAR,HWI,IIAFT,IIBAL,DI  1700
     1IIFWD,IIBYM,IIWC,IIWM,IJWL,IPWC,IPWM,IPWL,IBREAK,ICOMP,ICHECK,INITDI  1800
     1,ISENTL,ISPANO,ISTAT,IBLOP,ITEST1,ITEST3,IY,JBREAK                DI  1900
      COMMON/P/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIAUTT,NIDSPL,NIHEEL,NILCGDI  2000
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2100
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,R,SIGHIP,SBS,SJGHIDI  2200
     1P,SPACE,STATNO,SECTIM,TCB,TCBIC,TCBS,TCOIS,TCOSS,THETIM,THETIT,THEDI  2300
     1TAT,THETJM,TPI,TRIM3,VCBIC,VCBS,VCOIS,VCOSS,VOL                   DI  2400
      COMMON/3/VOLIC,VOLID,VOLS,VOLS,WAVCEN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2500
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPS,XJLIM,XDI  2600
     1ALIM,XIIL,XIIT,XKM,XKM3,XKML,XKMT,XLIDAM,XLBP,XLCB,XLCBIC,XLCB3,XLDI  2700
     1CP,XLCP3,XLCS,XLCWIW,XLCOS,XLMBIR,XLMBD4,XMID,XMOMIL,XMOM3V,XMTI,YDI  2800
     1,YI,YIMA,Z,WAVLOC ,XIDAM6,XPDAM6,XLMBPR,IABAL                     DI  2900
      COMMON/4/ICAT,YINT,NJHEEL,THETJM,LIMIT                            DI  3000
      VOLI=0.0                                                          VO  3400
      SIGHIP = 0.0                                                      VO  3500
      XMOM3V = 0.0                                                      VO  3600
      XMOM3T=0.0                                                        VO  3700
      XMOMIL=0.0                                                        VO  3800
      XMOMBL = 0.                                                       VO  3810
      CALL DRAFT                                                        VO  3900
      DO 100 ISTAT = 1,NSTAT                                            VO  4000
      CALL AREAS                                                        VO  4100
  100 CONTINUE                                                          VO  4200
      GO TO(150,150,175,374),KVOL                                       VO  4300
  150 NSTAT1=1                                                          VO  4400
      NSTAT2 = NNSTAT                                                   VO  4500
      ITEST3=3                                                          VO  4600
      GO TO (175,175),KVOL                                              VO  4700
  374 ITEST3 = 1                                                        VO  4800
      GO TO 375                                                         VO  4900
  175 VOLIC(I)=0.0                                                      VO  5000
      VCBIC(I)=0.0                                                      VO  5100
      TCBIC(I)=0.0                                                      VO  5200
      XLCBIC(I)=0.0                                                     VO  5300
      NCOMP1=NSTAT4=(ICHECK-1)                                          VO  5400
      ITEST1=2                                                          VO  5500
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 375 DO 400 J = 1,NCOMP1                                                VO  5600
     GO TO (9999,470,475,475),KVOL                                      VO  5700
 425 XIDAM(J) = X(1)                                                    VO  5800
     JPKK=J+ICHECK-1                                                    VO  5900
     XBDAM(J) = X1W(JPKK)                                               VO  6000
 470 XTEST=XIDAM(J)                                                     VO  6100
     N=1                                                                VO  6200
 499 DO 800 ISTAT1=1,NSTAT                                              VO  6300
 510 IF(ABS(XTEST-XBS(ISTAT1))-0.0001) 530,530,5015                     VO  6400
 5015 IF(XTEST -XBS(ISTAT1))525,530,800                                 VO  6500
 525 IF(ISTAT1-NSTAT)530,535,535                                        VO  6600
 530 ISTAT2=ISTAT1                                                      VO  6700
     GO TO 540                                                          VO  6800
 535 IF(H(ISTAT1) .NE. H(ISTAT1+1)) GO TO 531                           VO  6900
     IF(H(ISTAT1 -1) .NE. H(ISTAT1-2))GO TO 534                         VO  6905
     DELX = XBS(ISTAT1) - XBS(ISTAT1-1)                                 VO  6910
     DELX1 = XTEST - XBS(ISTAT1-1)                                      VO  6915
     AREA3S(N) = (AREABS(ISTAT1)-AREABS(ISTAT1-1))/DELX * DELX1 +AREABSVO  6920
    1(ISTAT1-1)                                                         VO  6921
     TCO3S(N) = (TCOBS(ISTAT1)-TCOBS (ISTAT1-1)) / DELX*DELX1+          VO  6930
    1TCOBS(ISTAT1 - 1)                                                  VO  6931
     VCO3S(N)=(VCOBS(ISTAT1)-VCOBS(ISTAT1-1))/DELX*DELX1+VCOBS          VO  6935
    1(ISTAT1 - 1)                                                       VO  6936
     ICOMP(N) = ISTAT1 + N - 2                                          VO  6940
     GO TO 560                                                          VO  6945
 531 ISTAT2 = ISTAT1 + 1                                                VO  7000
 540 CALL COEFF1(XBS(ISTAT2-2),XBS(ISTAT2-1),XBS(ISTAT2),XTEST)         VO  7100
     ISTAT2=ISTAT                                                       VO  7200
     HOBASC=FINTP2(H(ISTAT2-1),H(ISTAT2),H(ISTAT2-2))                   VO  7300
     C2A=C1A                                                            VO  7400
     C2B=C1B                                                            VO  7500
     C2C=C1C                                                            VO  7600
     DO 5010   I=1,3                                                    VO  7700
     ISTAT=ISTAT2+I-1                                                   VO  7800
     AREABS(I)=AREABS(ISTAT)                                            VO  7900
     VCOBS(I)=VCOBS(ISTAT)                                              VO  8000
     TCOBS(I)=TCOBS(ISTAT)                                              VO  8100
     HBS(I)=H(ISTAT)                                                    VO  8200
     H(ISTAT)=HOBASC                                                    VO  8300
     CALL AREAB                                                         VO  8400
5010 CONTINUE                                                           VO  8500
     C1A=C2A                                                            VO  8600
     C1B=C2B                                                            VO  8700
     C1C=C2C                                                            VO  8800
 545 AREA3S(N)=FINTP2(AREABS(ISTAT2-1),AREABS(ISTAT2),AREABS(ISTAT2-2))VO  8900
     VCO3S(N)=FINTP2(VCOBS(ISTAT2-1),VCOBS(ISTAT2),VCOBS(ISTAT2-2))     VO  9000
     TCO3S(N)=FINTP2(TCOBS(ISTAT2-1),TCOBS(ISTAT2),TCOBS(ISTAT2-2))     VO  9100
     ICOMP(N)=ISTAT+N-2                                                 VO  9200
     DO 5020   I=1,3                                                    VO  9300
     ISTAT=ISTAT2+I-1                                                   VO  9400
     AREABS(ISTAT)=AREABS(I)                                            VO  9500
     VCOBS(ISTAT)=VCOBS(I)                                              VO  9600
     TCOBS(ISTAT)=TCOBS(I)                                              VO  9700
5020 H(ISTAT)=HBS(I)                                                    VO  9800
     ISTAT=ISTAT2                                                       VO  9900
     GO TO 560                                                          VO 10000
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      IF(X(ISTAT1)-X(ISTAT1+1))884,882,884                              VO 10100
      IF(XTEST-XRDAM(J))886,884,886                                     VO 10200
  884 ISTAT1 = ISTAT1 + 1                                               VO 10300
  886 AREASB(N) = AREASB(ISTAT1)                                        VO 10400
      VCOSB(N)=VCOSB(ISTAT1)                                            VO 10500
      TCOSB(N)=TCOSB(ISTAT1)                                            VO 10600
      ICOMP(N)=ISTAT1                                                   VO 10700
  890 IF(XTEST-XRDAM(J))800,600,9999                                    VO 10800
  892 XTEST=XRDAM(J)                                                    VO 10900
      N=2                                                               VO 11000
      GO TO 819                                                         VO 11100
  800 CONTINUE                                                          VO 11200
 9999 STOP                                                              VO 11300
  600 NSTAT1=ICOMP(1)                                                   VO 11400
      NSTAT2=ICOMP(2)                                                   VO 11500
      AREASB(NSTAT1)=AREASB(1)                                          VO 11600
      VCOSB(NSTAT1)=VCOSB(1)                                            VO 11700
      TCOSB(NSTAT1)=TCOSB(1)                                            VO 11800
      XBB(NSTAT1)=XRDAM(J)                                              VO 11900
      AREASB(NSTAT2)=AREASB(2)                                          VO 12000
      VCOSB(NSTAT2)=VCOSB(2)                                            VO 12100
      TCOSB(NSTAT2)=TCOSB(2)                                            VO 12200
      XBB(NSTAT2)=XRDAM(J)                                              VO 12300
  699 NSTAT2=NSTAT2-1                                                   VO 12400
  691 GO TO(9999,170,170,170),KVOL                                      VO 12500
  170 M2=0                                                              VO 12600
      IF(ABS(AREASB(NSTAT1))-.1)9110,9110,9140                          VO 12700
 9110 M=NSTAT1+1                                                        VO 12800
 9120 IF(ABS(AREASB(M))-.1)9130,9130,9140                               VO 12900
 9130 IF(NSTAT1-M2-NSTAT2) 9132,9131,9131                               VO 13000
 9131 VOL1 = 0.                                                         VO 13100
      SISHIP = 0.                                                       VO 13200
      GO TO 801                                                         VO 13300
 9132 M = M+1                                                           VO 13400
      M2=M2+1                                                           VO 13500
      GO TO 9120                                                        VO 13600
 9140 NSTAT1=NSTAT1+M2                                                  VO 13700
      IF(NSTAT1-NSTAT2)9133,9134,9133                                   VO 13800
 9134 NSTAT1 = NSTAT1 - 1                                               VO 13900
      GO TO 6783                                                        VO 14000
 9133 M2 = 0                                                            VO 14100
      IF(ABS(AREASB(NSTAT2))-.1)9150,9150,9160                          VO 14200
 9150 M=NSTAT2-1                                                        VO 14300
 9160 IF(ABS(AREASB(M))-.1)9170,9170,9180                               VO 14400
 9170 M2=M2+1                                                           VO 14500
      M=M-1                                                             VO 14600
      GO TO 9160                                                        VO 14700
 9180  NSTAT2 = NSTAT2-M2                                               VO 14800
 6783 ISTAT = NSTAT1                                                    VO 14900
  194  CALL TEST2                                                       VO 15000
      ISTAT2=M                                                          VO 15100
      GO TO (7017,884,883),K                                            VO 15150
  883 XBM = X1M                                                         VO 15175
      X1M = X1M - XBB(ISTAT)                                            VO 15188
      DELX = XBB(ISTAT + 1) - XBB(ISTAT)                                VO 15200
  884 DELX= XBB(ISTAT+1)-XBB(ISTAT)                                     VO 15301
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      AREAIM=(AREABS(ISTAT+1)-AREABS(ISTAT))/DELX * XIM +AREABS(ISTAT)   VO 15800
      TCOIM =(TCOBS(ISTAT+1)-TCOBS(ISTAT))/DELX * XIM + TCOBS(ISTAT)     VO 15900
      VCOIM =(VCOBS(ISTAT+1)-VCOBS(ISTAT))/DELX * XIM + VCOBS(ISTAT)     VO 16000
      SIM = (SBS(ISTAT+1)-SBS(ISTAT))/DELX*XIM + SBS(ISTAT)              VO 16100
      XIM = XBM                                                          VO 16200
      GO TO 271                                                          VO 16300
  295 AREAIM=AREABS(ISTAT+1)                                             VO 16400
      VCOIM=VCOBS(ISTAT+1)                                               VO 16500
      TCOIM=TCOBS(ISTAT+1)                                               VO 16600
      SIM = SBS(ISTAT+1)                                                 VO 16700
      GO TO 275                                                          VO 16800
 7017 HOBABC=FINTP2(H(ISTAT2-1),H(ISTAT2),H(ISTAT2-2))                   VO 16900
      ISTAT2=ISTAT                                                       VO 17000
      C2A=C1A                                                            VO 17100
      C2B=C1B                                                            VO 17200
      C2C=C1C                                                            VO 17300
      DO 7018   I=1,3                                                    VO 17400
      ISTAT=ISTAT2+I-1                                                   VO 17500
      AREABS(I)=AREABS(ISTAT)                                            VO 17600
      VCOBS(I)=VCOBS(ISTAT)                                              VO 17700
      TCOBS(I)=TCOBS(ISTAT)                                              VO 17800
      HBS(I)=H(ISTAT)                                                    VO 17900
      H(ISTAT)=HOBABC                                                    VO 18000
      CALL AREAS                                                         VO 18100
 7018 CONTINUE                                                           VO 18200
      C1A=C2A                                                            VO 18300
      C1B=C2B                                                            VO 18400
      C1C=C2C                                                            VO 18500
  240 M=ISTAT2                                                           VO 18600
      AREAIM=FINTP2(AREABS(M-1),AREABS(M),AREABS(M-2))                   VO 18700
      IF(AREAIM)9181,9188,9188                                           VO 18800
 9181 AREAIM=0.                                                          VO 18900
 9188 VCOIM = FINTP2(VCOBS(M-1),VCOBS(M),VCOBS(M-2))                     VO 19000
      TCOIM=FINTP2(TCOBS(M-1),TCOBS(M),TCOBS(M-2))                       VO 19100
      SIM = FINTP2(SBS(M-1),SBS(M),SBS(M-2))                             VO 19200
 7019 DO 7020   I=1,3                                                    VO 19300
      ISTAT=ISTAT2+I-1                                                   VO 19400
      AREABS(ISTAT)=AREABS(I)                                            VO 19500
      VCOBS(ISTAT)=VCOBS(I)                                              VO 19600
      TCOBS(ISTAT)=TCOBS(I)                                              VO 19700
 7020 H(ISTAT)=HBS(I)                                                    VO 19800
      ISTAT=ISTAT2                                                       VO 19900
 7021 IF(I-NSTAT2)275,271,275                                            VO 20000
  271 M = ISTAT + 1                                                      VO 20100
  275 VOL1 = VOL1 + FINTO1(AREABS(ISTAT),AREAIM,AREABS(M),SPACE/3.0)     VO 20200
      XMOM3V = XMOM3V + FINTO1(AREABS(ISTAT)*VCOBS(ISTAT),AREAIM*VCOIM,AVO 20300
     1REABS(M) *VCOBS(M),SPACE/3.0)                                      VO 20400
      XMOM3T=XMOM3T+ FINTO1(AREABS(ISTAT)*TCOBS(ISTAT),AREAIM*TCOIM,AREAVO 20500
     1BS(M) *TCOBS(M),SPACE/3.0)                                         VO 20600
      XMOM1L = XMOM1L + FINTO1(AREABS(ISTAT)*XBS(ISTAT),AREAIM*XIM,AREAVO 20700
     1BS(M) *XBS(M),SPACE/3.0)                                           VO 20710
      XMOM2L = XMOM2L +FINTO1(AREABS(ISTAT)*XBS(ISTAT)**2,AREAIM*XIM**2, VO 20720
     1AREABS(M)*XBS(M)**2,SPACE/3.0)                                     VO 20800
      IF(ITEST3-3)200,290,200                                            VO 20900
  290 SISHIP = SISHIP + FINTO1(SBS(ISTAT),SIM,SBS(M),SPACE*2.0/3.0)      VO 20910
  200 ISTAT = ISTAT + 2                                                  VO 20000
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      IF(ISTAT - NSTATP) 176,176,801                                    VO 20100
  801 GO TO (820,800,810),ITEST                                         VO 20200
  800 VOLIC(JPKK)=VOL1                                                  VO 20300
      IF (ABS(VOL1)- .00001) 801,801,809                                VO 20400
  801 VCBIC(JPKK) = 0.0                                                 VO 20500
      TCBIC(JPKK)=0.0                                                   VO 20600
      XLCBIC(JPKK) = 0.0                                                VO 20700
      GO TO 836                                                         VO 20800
  802 VCBIC(JPKK) = XMOM3V/VOL1                                         VO 20900
      TCBIC(JPKK)=XMOM3T/VOL1                                           VO 21000
      XLCBIC(JPKK)=XMOMIL/VOL1                                          VO 21100
      GO TO 836                                                         VO 21200
  810 VOL = VOL1                                                        VO 21300
      DISPL = VOL1/39.0                                                 VO 21400
      IF (ABS(VOL1)- .00001) 811,811,812                                VO 21500
  811 XKB = 0.0                                                         VO 21600
      TCB=0.0                                                           VO 21700
      XLCB = 0.0                                                        VO 21800
      GO TO 814                                                         VO 21900
  812 XKB = XMOM3V/VOL1                                                 VO 22000
      XLCB = XMID = (XMOMIL/VOL1)                                       VO 22100
      TCB=XMOM3T/VOL1                                                   VO 22200
  814 GO TO (820,830),KVOL                                              VO 22300
  820 ITEST=1                                                           VO 22400
      VOL1 = 0.0                                                        VO 22500
      XMOM3V = 0.0                                                      VO 22600
      XMOM3T=0.0                                                        VO 22700
      XMOMIL = 0.0                                                      VO 22800
      XMOMBL = 0.                                                       VO 22810
      GO TO 375                                                         VO 22900
  830 RETURN                                                            VO 23000
  899 VOLIC(J) = VOLTOPERM(J)                                           VO 23100
      IF(VOL1)8750,8750,8760                                            VO 23200
 8750 VCBIC(J) = 0.0                                                    VO 23300
      TCBIC(J)=0.0                                                      VO 23400
      XLCBIC(J) = 0.0                                                   VO 23500
      XLVR(J) = 0.                                                      VO 23510
      GO TO 836                                                         VO 23600
 8760 VCBIC(J) = XMOM3V/VOL1                                            VO 23700
      TCBIC(J)=XMOM3T/VOL1                                              VO 23800
      XLCBIC(J) = XMID-(XMOMIL/VOL1)                                    VO 23900
      XLVR(J) = SQRT(XMOMBL/VOL1)                                       VO 23910
  836 VOL1=0.0                                                          VO 24000
      XMOM3V=0.0                                                        VO 24100
      XMOM3T=0.0                                                        VO 24200
      XMOMIL=0.0                                                        VO 24300
      XMOMBL = 0.                                                       VO 24310
      ISTAT=NSTAT1                                                      VO 24400
      CALL AREAS                                                        VO 24500
      ISTAT = NSTATP + 1                                                VO 24600
  840 CALL AREAS                                                        VO 24700
  900 CONTINUE                                                          VO 24800
      GO TO (9999,300,820,820),KVOL                                     VO 24900
  300 DO 399  J=1,NCOMP1                                                VO 25000
      XKB=(VOL*XKB-VOLIC(J)*VCBIC(J))/(VOL-VOL1C(J))                    VO 25100
      TCB=(VOL*TCB-VOLIC(J)*TCBIC(J))/(VOL-VOL1C(J))                    VO 25200
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      XLCB=(VOL*XLCB-VOLIC(J)*XLCBIC(J))/(VOL-VOLIC(J))                 VO 00300
                                                                        VO 00400
  300 VOL=VOL-VOLIC(J)                                                  VO 00500
      RETURN                                                            VO 00600
      END
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      SUBROUTINE WAVP                                                                  WA   200
      DIMENSION AMEAIR(20,20),AREAPR(60),AREAAR(20,30),AML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(3),DISPLS(20),DI   400
     1OWL(20),H(60),HICOMP(20),HIHOR(60),HIMAR(60),HIOUT(20),HISAO(60),HDI   500
     1ICOMP(20),ICOMP(2),JMREAK(60,10),JMAX(3),KMAX(2,3),NP(8),NAME(8),NDI   600
     1AMEIR(8),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                          DI   700
      DIMENSIONPERMP(10),RAD(6,5,10),S(60,20),SPS(60),SHIP(20),STATNO(DI   800
     160),SECTIM(20),TCRIC(20),TCRO(5,5,10),TCOIR(60,20),TCOPR(60),THETDI   900
     1M(10),TPI(20),THIMI(6),VCRIC(60),VCRO(5,5,10),VCOIR(60,20),VCOPR(6DI  1000
     10),VOL3(20),VOIR(8),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAMP(10DI  1100
     1),XIDAMO(20),XPDAMO(60),XIW(20),XPDAM(30),XRDAME(18)                     DI  1200
      DIMENSIONXPS(60),XKR3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCRIC(20DI  1300
     1),XLCM3(20),XLCF3(20),XLCOIW(20),XLCOR(8),XMTI(20),Y(60,20),Y1(60)DI  1400
     1,Z(60,20) ,YIINT(4,30),THETIM(8)                                         DI  1500
      DIMENSION XLYM(20)                                                        DI  1600
      COMMON/1/AIMA,AIWP,AIWPJ,AMLAIR,AMPAPR,AMPAAR,AML,AMT,CIA,CIALPH,CDI  1700
     1IN,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,OWL,H,HIMAGE,HICOMPDI  1800
     1,HICOMP,HIHOR,HIMAR,HIOUT,HISAO,HOMAR,HOMAR,HW1,IIAPT,IIRAL,DI  1900
     1IIFWD,IIGYM,IIWC,IIWH,IIWL,IRWC,IPWH,IPWL,IRREAK,ICOMP,ICHECK,INITDI  2000
     1,ISENTI,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JMREAK                       DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIROUT,NIOSPL,NIMERL,NILCGDI  2200
     1,NIPERM,NITRIM,NAME,NAMEIR,NCOMPI,NCOMPP,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1STAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAD,S,SIGHIP,SPS,SIGHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRO,TCOIR,TCOPR,THETIM,THETIT,THEDI  2500
     1TPI,THETOM,TPI,THIMI,VCRIC,VCRO,VCOIR,VCOPR,VOL                          DI  2600
      COMMON/3/VOLIC,VOLID,VOL3,VOLR,WAVCEN,WCIINC,WEIGHT,WWIINC,WWIMUL,DI  2700
     1WLIINC,X,XIDAM,XIDAMP,XILIM,XIM,XIW,XPDAM,XPDAMP,XPLIM,XPS,XSLIM,XDI  2800
     1ALIM,XTIL,XTIT,XKR,XKR3,XKML,XKMT,XLIDAM,XLBP,XLCR,XLCRIC,XLCR3,XLDI  2900
     1CF,XLCF3,XLCO,XLCOIW,XLCOR,XLMRIR,XLMRDA,XMID,XMOMII,XMOM3V,XMTI,YDI  3000
     1,Y1,YIMA,Z,WAVLOC ,XIDAMO,XPDAMO,XLMRPR,IABAL                            DI  3100
      COMMON/4/ICAT,YIINT,NSHEEL,THETIM,LIMIT                                   WA  3200
      WWIMUL = (FLOAT((-IWW / 2) + IPWH - 1) * WWIINC) + 1.0                    WA  3300
      XLMRPR = XLMRIR * ((FLOAT((-IWL / 2) + IPWL - 1) * WLIINC)+1.0)           WA  3400
      WAVLOC = WAVCEN + FLOAT((IIWC / 2) - IPWC + 1) * WCIINC * XLMRPR          WA  3500
     1                                                 * XLMP                   WA  3600
      XLMRDA=XLMRPR*XLBP                                                        WA  3700
      HW1 = HW1 + 1                                                             WA  3800
      IHW = HW1                                                                 WA  3900
      GO TO (61,62,63),IHW                                                      WA  4000
   61 HW2=( (1.1*SQRT(XLBP))/2.0 )*WWIMUL                                       WA  4100
      GO TO 64                                                                  WA  4200
   62 HW2=(                                                                     WA  4300
     1     XLBP/40.0          )*WWIMUL                                          WA  4400
      GO TO 64                                                                  WA  4500
   63 HW2 = 2.02*XLBP**.4                                                       WA  4600
   64 IHOO=1                                                                    WA  4700
      GO TO 30                                                                  WA  4800
   40 IHOO=(-1)                                                                 WA  4900
   30 DO 10  I=1,LIMIT                                                          WA  5000
C    IF IHOO=+1,SHIP IS HOGGING,IF-1,SHIP IS SAGGING                           WA  5100
      XP=ABS(X(I)+(XLBP/2.0)*(XLMR2R-1.0)*WAVLOC)                               WA  5200
      IF(IHOO)  21,21,22                                                        WA  5300
   21 XP=XP*XLMRDA/2.0                                                          WA  5400
   22 IF (XP-XLMRDA/2.0)    23,23,20                                            WA  5500
   20 XP=ABS(XLMRDA-XP)                                                         WA  5600
      GO TO 22
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 23    CONTINUE                                                          WA  5300
       THETA=XB*6.2832/ALMBDA                                            WA  5400
       RADIUS=ALMBDA/6.2832                                              WA  5500
       IF (HWB-RADIUS) 7,7,7002                                          WA  5600
 7002  PRINT  7003                                                       WA  5700
 7003  FORMAT(63H WAVE HEIGHT TOO LARGE FOR WAVE LENGTH. INVALID RESULTS WA  5800
      1 FOLLOW     )                                                    WA  5900
       RETURN                                                            WA  6000
 7     X1=RADIUS*THETA*(HWB)*SIN(THETA)                                  WA  6100
C    X1=TRIAL VALUE OF X(I)                                             WA  6200
       IF (ABS(XB-X1)-0.005) 5,5,6                                       WA  6300
 6     THETA=THETA*((XB-X1)/ALMBDA)*6.2832                               WA  6400
       GO TO 7                                                           WA  6500
 5     HW=HWB*(1.0-COS(THETA))                                           WA  6600
       IF(IMOD)  71,71,70                                                WA  6700
 70    HIMOD(I)=HW                                                       WA  6800
       GO TO 16                                                          WA  6900
 71    HIBAD(I)=HW                                                       WA  7000
 16    CONTINUE                                                          WA  7100
       IF(IMOD)   35,99,40                                               WA  7200
 35    RETURN                                                            WA  7300
       END                                                               WA  7400
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      SUBROUTINE WETSRF                                                 WE   200
      DIMENSION Z1(3),WS(3)                                             WE   300
      DIMENSIONAIWP3(20),AREAIB(60,20),AREAPB(60),AREA6B(20,30),BML(20),DI   400
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   500
     1DWL(20),H(60),HICOMP(20),HIMOD(60),HIMAR(40),HIOUT(20),HIBAG(40),HDI   600
     1BCOMP(20),ICOMP(4),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   700
     1AMEIB(8),NCOMPP(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   800
      DIMENSIONPERM2(10),RAB(6,6,10),S(40,20),SPB(60),STRMIP(20),STATNO(DI   900
     160),SECTIM(20),TCBIC(20),TCBB(6,6,10),TCBIB(60,20),TCBPB(60),THETADI  1000
     1M(10),TP1(20),THIM3(6),VCBIC(20),VCBB(6,6,10),VCBIB(60,20),VCBPB(6DI  1100
     10),VOL3(20),VOL6(6),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAMP(10DI  1200
     11),XIDAM6(20),XBDAM6(20),XIW(20),XBDAM(30),XBDAMP(10)             DI  1300
      DIMENSIONXB(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCBIC(20DI  1400
     1),XLCB3(20),XLCP3(20),XLCBIW(20),XLCB6(6),XMTI(20),Y(60,20),Y1(60)DI  1500
     1,Z(60,20) ,YLINT(4,30),THETJM(6)                                  DI  1600
      DIMENSION XLVM(20)                                                DI  1700
      COMMON/1/AIMA,AIWP,AIWPJ,AREAIB,AREABB,ARPA6B,BML,BMT,CIA,CIALPHACOI  1800
     1IB,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  1900
     1,H2COMP,HIMOD,HIMAR,HIOUT,HIBAG,H2MAR,H3MAR,H4MAR,HWL,IIAFT,IINAL,DI  2000
     1IIFWD,IIBYM,IIWC,IIWH,IIWL,IPWC,IPWH,IPWL,IBREAK,ICOMP,ICHECK,INITDI  2100
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  2200
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIRUTT,NIOSPL,NIWEEL,NILCODI  2300
     1,NIPERM,NITRIM,NAME,NAMEIB,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2400
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SIBMIP,SPB,STBMIDI  2500
     1P,SPACE,STATNO,SECTIM,TCB,TCBIC,TCBS,TCBIB,TCBPB,THETJM,THETIP,THEDI  2600
     1TAT,THETBM,TPI,TRIM3,VCWIC,VCBB,VCBIB,VCBPB,VOL                   DI  2700
      COMMON/3/VOLIC,VOLID,VOL3,VOL6,WAVCRN,WCIINC,WEIGHT,WHIINC,WHIMUL,DI  2800
     1WLIINC,X,XIDAM,XIDAMP,XILIM,XIM,XIW,XPDAM,XPDAMP,XPLIM,XPB,XPLIM,XDI  2900
     1OLIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLMP,XLCB,XLCBIC,XLCB3,XLDI  3000
     1CP,XLCP3,XLCB,XLCBIW,XLCB6,XLMBIB,XLMBDA,XMID,XMOMIL,XMOMJV,XMTI,YDI  3100
     1,Y1,YIMA,Z,WAVLOC ,XIDAM6,XBDAM6,XLMBPB,IABAL                     DI  3200
      COMMON/4/ICAT,YLINT,NJWEEL,THETJM,LIMIT                           DI  3300
      ICOUNT = 0                                                        WE  3400
      DO 10 I = 1,3                                                     WE  3500
      J = IY-1+I                                                        WE  3600
      IF (ABS(Y(ISTAT,J))- .000001 ) 90,90,10                           WE  3700
   90 ICOUNT = ICOUNT + 1                                               WE  3800
   10 Z1(I) = Z(ISTAT,J)                                                WE  3900
      IF(ICOUNT - 3) 14,60,60                                           WE  4000
   60 S(ISTAT, IY+1) = S(ISTAT,IY)                                      WE  4100
      S(ISTAT, IY+2) = S(ISTAT,IY)                                      WE  4200
      GO TO 80                                                          WE  4300
   14 IF (ABS(CIA )-.00001) 16,16,18                                    WE  4400
   18 CB = SQRT(1.0- CIA**2)                                            WE  4500
      DO 30 I = 1,3                                                     WE  4600
   30 WS(I) = CB*Z1(I)                                                  WE  4700
      GO TO 40                                                          WE  4800
   16 CBA = 4.0*CIA**2                                                  WE  4900
      CBB =4.0*CIA*CIB                                                  WE  5000
      CBC = CIB**2 + 1.0                                                WE  5100
      DO 21 I = 1,3                                                     WE  5200
      CBX = SQRT(FINTP1(Z1(I),CBA,CBB,CBC))                             WE  5300
      CBX = 2.0*CBA*Z1(I)+CBB+2.0*SQRT(CBA)*CBX                         WE  5400
      IF (CBX)       21,20,20                                           WE  5500
   21 WS(I) = 0.0                                                       WE  5600
      DO 25      J = 1,2                                                WE  5700
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      IVJ=IV+J                                                          WE  0700
   30 WS(J+1) = ...((Z(ISTAT,IVJ)-Z(ISTAT,IV))**2 +(YI(ISTAT,IVJ)-YI(ISWE 0800
     1STAT,IV))**2)                                                     WE  0900
      GO TO 40                                                          WE  1000
   50 WS(1) = ((B.0**2*A*Z1(I)*CBB)*CBX)/(4.0*CBA) + ((4.0*CBA*CBC-CBB**2WE 1100
     1)/(8.0*CBA))*(1.0/SQRT(CBA))*ALOG(C3X)                            WE  1200
   60 S(ISTAT,IV+1) = WS(2) - WS(1) + S(ISTAT,IV)                       WE  1300
      S(ISTAT,IV+2) = WS(3) - WS(1) + S(ISTAT,IV)                       WE  1400
   80 RETURN                                                            WE  1500
      END                                                               WE  1600
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      SUBROUTINE WPLAN1                                                 WP    200
      DIMENSION A(WP3(20),AREA1S(60,20),AREA2S(60),AREA4S(20,30),AML(20),DI    300
     1MMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL3(20),DI    400
     1DWL(20),H(60),HICOMP(20),HIHOO(60),HIMAN(60),HIOUT(20),HISAO(60),HDI    500
     1ZCOMP(20),ICOMP(2),JBREAK(60,10),JMAX(9),KMAX(20,3),KP(8),NAME(8),NDI    600
     1AME1S(8),NCOMPS(2,3,3),NP(60),PERM(1M),PERM1(3)                   DI    700
      DIMENSION PERMP(18),RAB(5,5,10),R(60,20),SPS(60),STSHIP(20),STATNO(DI    800
     160),SECTIM(20),TCRIC(20),TCRS(5,5,10),TCSIR(60,20),TCORS(60),THETSDI    900
     1M(10),TPI(20),TRIM3(6),VCRIC(20),VCRS(5,5,10),VCSIR(60,20),VCORS(6DI   1000
     10),VOL3(20),VOLS(9),VOLIC(25),WEIGHT(20),X(60),XIDAM(30),XIDAM2(10DI   1100
     1),XIDAM4(20),XPDAM4(20),XIW(20),XPDAM(30),XPDAM2(10)              DI   1200
      DIMENSION XBS(60),XKB3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCRIC(20DI   1300
     1),XLCR3(20),XLCP3(20),XLCSIW(20),XLCRS(9),XMTI(20),Y(60,20),YI(60)DI   1400
     1,Z(60,20) ,YINT(6,30),THETSM(9)                                   DI   1500
      DIMENSION ALVM(20)                                                DI   1600
      COMMON/1/AIMA,AIWP,AIWP3,AREA1S,AREA2S,AREA4S,AML,AMT,CIA,CIALPH,CDI   1700
     1IM,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HINABC,HICOMPDI   1800
     1,HZCOMP,HIHOO,HIMAN,HIOUT,HISAO,HPMAN,HSMAN,HWMAP,HWL,IIAFT,IIHAL,DI   1900
     1II,IWD,IISYM,IIWC,IIWH,IIWL,IZWC,IPWH,IPWL,IBREAK,ICOMP,ICHPKD,INITDI   2000
     1,ISENTL,ISPANO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI   2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHEEL,NILCGDI   2200
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI   2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SISHIP,SPS,STSHIDI   2400
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRS,TCSIR,TCORS,THETIM,THETIT,THRDI   2500
     1TST,THETSM,TPI,TRIM3,VCRIC,VCRS,VCSIR,VCORS,VOL                   DI   2600
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCFN,WCLINC,WEIGHT,WMLINC,WMLMUL,DI   2700
     1WLLINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPS,XSLIM,XDI   2800
     1SLIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XLIDAM,XLBP,XLCR,XLCRIC,XLCR3,XLDI   2900
     1CP,XLCP3,XLCS,XLCSIW,XLCRS,XLMRIP,XLMRPA,XMID,XMOMIL,XMOMJV,XMTI,YDI   3000
     1,YI,YIMA,Z,WAVLOC ,XIDAM3,XPDAM3,XLMRPP,IABAL                     DI   3100
      COMMON/4/ICAT,VIINT,NSHEEL,THETSM,LIMIT                           DI   3200
      M= NP(ISTAT)                                                      WP   3300
      CALL TEST1(M(ISTAT),Z)                                            WP   3400
      GO TO (5,10,40,5),M                                               WP   3500
    5 YI(ISTAT) = 0.0                                                   WP   3600
      GO TO 10                                                          WP   3700
   30 YI(ISTAT)= Y(ISTAT,NWP)                                           WP   3800
      GO TO 10                                                          WP   3900
   40 DO 30 IBREAK = 1,10                                               WP   4000
      IF(JBREAK(ISTAT,IBREAK)-NWP-1)30,50,30                            WP   4100
   30 CONTINUE                                                          WP   4200
   40 M = NWP                                                           WP   4300
      GO TO 80                                                          WP   4400
   50 IF(JBREAK(ISTAT,IBREAK-1)-NWP)  60,61,60                          WP   4500
   61 YI(ISTAT)=Y(ISTAT,NWP)+(Y(ISTAT,NWP+1)-Y(ISTAT,NWP))              WP   4600
     1                          *(M(ISTAT)-Z(ISTAT,NWP))/              WP   4700
     2      (Z(ISTAT,NWP)-Z(ISTAT,NWP+1))                              WP   4800
      RETURN                                                            WP   4900
   60 M = NWP-1                                                         WP   5000
   80 Z1 = Z(ISTAT,M)                                                   WP   5100
      ZR = Z(ISTAT,M+1)                                                 WP   5200
      Z3 = Z(ISTAT,M+2)                                                 WP   5300
      CALL COEFF1(Z1,ZR,Z3,M(ISTAT))                                    WP   5400
      YI(ISTAT) = FINTP2(Y(ISTAT,M+1),Y(ISTAT,M+2),Y(ISTAT,M))          WP   5500
      IF(YI(ISTAT))2000,10,10                                           WP   5600
 2000 YI(ISTAT) = 0.0                                                   WP   5700
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10    RETURN                                                    WP  8700
      END                                                       WP  8800
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      SUBROUTINE WPLANE                                                 WP    200
      DIMENSIONAIWP3(20),AREAIS(60,20),AREA2S(60),AREA4S(20,30),AML(20),DI    300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIOUFT(20),DATE(2),DISPL3(20),DI    400
     1DWL(20),H(60),HICOMP(20),HIMOG(60),HIMAR(40),HIOUT(20),HISAG(40),HDI    500
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(7),KMAX(2,3),KP(6),NAME(8),NDI    600
     1AME1S(8),NCOMP(2,3,3),NP(60),PERM(18),PERM1(3)                    DI    700
      DIMENSIONPERMP(18),RAB(5,5,10),S(40,20),SPS(60),SSHIP(20),STATNO(DI    800
     160),SECTIM(25),TCRIC(20),TCRS(5,5,10),TCQIS(60,20),TCQRS(60),THETSDI    900
     1M(10),TPI(20),TRIM3(6),VCRIC(20),VCRS(5,5,10),VCQIS(60,20),VCQRS(6DI   1000
     10),VOL3(20),VOL4(4),VOLIC(20),WEIGHT(20),X(60),XIDAM(20),XIDAMP(18DI   1100
     1),XIDAM4(20),XPDAMS(20),XIW(20),XPDAM(30),XPDAM2(18)              DI   1200
      DIMENSIONXP4(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCRIC(20DI   1300
     1),XLCR3(20),XLCP3(20),XLCQIW(20),XLCQS(5),XMTI(20),Y(60,20),YI(60)DI   1400
     1,Z(60,20),YIINT(4,30),THETJM(6)                                   DI   1500
      DIMENSION XLVR(20)                                                DI   1600
      COMMON/1/AIMA,AIWP,AIWP3,AREAIS,AREA2S,AREA4S,AML,AMT,CIA,CIALPH,CDI   1700
     11S,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBALC,HICOMPDI   1800
     1,H2COMP,HIMOG,HIMAR,HIOUT,HISAG,H3MAR,H4MAR,HWI,IIAFT,IIMAL,DI   1900
     1I1FWD,I1SYM,I1WC,I1WH,I1WL,I2WC,I2WH,I2WL,IBREAK,ICOMP,ICHEKV,INITDI   2000
     1,ISENTL,ISFRNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI   2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NINUTT,NINSPL,NIMEEL,NILCSDI   2200
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI   2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SISHIP,SPS,SSHIDI   2400
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRS,TCQIS,TCQRS,THETIM,THETIT,THEDI   2500
     1TAT,THETSM,TPI,TRIM3,VCRIC,VCRS,VCQIS,VCQRS,VOL                   DI   2600
      COMMON/3/VOLIC,VOL3D,VOL3,VOL4,WAVCRN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI   2700
     1WLIINC,X,XIDAM,XIDAMS,XILIM,XIM,XIW,XPDAM,XPDAMS,XPLIM,XPS,XSLIM,XDI   2800
     1SLIM,XTIL,XTIT,XKR,XKR3,XKML,XKMT,XLIDAM,XLWP,XLCR,XLCRIC,XLCR3,XLDI   2900
     1CP,XLCP3,XLCQ,XLCQIW,XLCQR,XLMRIR,XLMRDA,XMIO,XMOMII,XMOM3V,XMTI,YDI   3000
     1,YI,YIMA,Z,WAVLOC,XIDAM3,XPDAM3,XLMRPR,IARAL                      DI   3100
      COMMON/4/ICAT,YIINT,NSHEEL,THETJM,LIMIT                           DI   3200
      AIWP=0.0                                                          WP   3300
      XIILI=0.0                                                         WP   3400
      XIIT=0.0                                                          WP   3500
      XMOMIW=0.0                                                        WP   3600
      XMOMIT=0.0                                                        WP   3700
      SIGN=-1.0                                                         WP   3800
      SIGN2 = +1.0                                                      WP   3900
      IF(ICAT-2)10,9,10                                                 WP   4000
    9 IF(ABSF(THETIM)-.0001) 10,10,30                                   WP   4100
   10 CALL DRAFT                                                        WP   4200
      DO 20 ISTAT = 1,LIMIT                                             WP   4300
      CALL WPLAN1                                                       WP   4400
   20 CONTINUE                                                          WP   4500
      IF(NSTAT-LIMIT)21,60,230                                          WP   4600
   21 DO 22 ISTAT = 1,NSTAT                                             WP   4700
      YIINT(1,ISTAT) = YI(ISTAT)                                        WP   4800
      YIINT(2,ISTAT) = YI(ISTAT)                                        WP   4900
      II = ISTAT + NSTAT                                                WP   5000
      YIINT(3,ISTAT) = YI(II)                                           WP   5100
      YIINT(4,ISTAT) = YI(II)                                           WP   5200
   22 CONTINUE                                                          WP   5300
   30 IHULL=1                                                           WP   5400
   40 DO 50 ISTAT=1,NSTAT                                               WP   5500
      YI(ISTAT) = YIINT(IHULL,ISTAT)                                    WP   5600
   50 CONTINUE                                                          WP   5700
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 40 DO 110 ISTAT=NSTAT1,NSTAT2,2                                                  WP  5700
    CALL TFST2                                                                    WP  5800
    GO TO(80,70,65),K                                                             WP  5900
 60 YIM=(Y1(ISTAT+1)-Y1(ISTAT))/(XBS(ISTAT+1)-XBS(ISTAT))*XIM+Y1(ISTATWP  5901
   1)                                                                             WP  5902
    GO TO 90                                                                      WP  5903
 70 YIM=Y1(ISTAT+1)                                                               WP  6000
    GO TO 100                                                                     WP  6100
 80 YIM=FINTP2(Y1(M-1),Y1(M),Y1(M-2))                                             WP  6200
    IF (1-NSTAT2)100,90,100                                                       WP  6300
 90 M=ISTAT+1                                                                     WP  6400
100 AIWP=(FINTO1(Y1(ISTAT),YIM,Y1(M),SPACE*2.0/3.0))*SIGN*AIWP                   WP  6500
    XIIT=(FINTO1(Y1(ISTAT)**3,YIM**3,Y1(M)**3,SPACE*2.0/3.))**SIGN*XIITWP  6600
    XMOMIW=(FINTO1(Y1(ISTAT)*X(ISTAT),YIM*XIM,Y1(M)*X(M),SPACE*2.0/3.0WP  6700
   1))*SIGN*XMOMIW                                                                WP  6800
    XIIL=(FINTO1(Y1(ISTAT)*(XMID-X(ISTAT))**2,YIM*(XMID-XIM)**2,Y1(M)*WP  6900
   1(XMID-X(M))**2,SPACE*2.0/3.0))*SIGN*XIIL                                      WP  7000
    XMOMIT = FINTO1(Y1(ISTAT)**2,YIM**2,Y1(M)**2,SPACE/3.) * SIGN2                WP  7100
   1*XMOMIT                                                                       WP  7200
110 CONTINUE                                                                      WP  7300
    IF (ICAT-2)170,180,170                                                        WP  7400
180 IF(IMULL-3)130,181,160                                                        WP  7500
190 IMULL = IMULL + 1                                                             WP  7600
    IF(IMULL-2)40,150,160                                                         WP  7700
140 SIGN = -1.0                                                                   WP  7800
    SIGN2 = +1.0                                                                  WP  7900
    GO TO 40                                                                      WP  8000
150 SIGN2 = -1.0                                                                  WP  8100
    GO TO 40                                                                      WP  8200
161 IMULL = IMULL + 1                                                             WP  8300
    SIGN2 = -1.0                                                                  WP  8400
    GO TO 40                                                                      WP  8500
160 AIWP = AIWP/2.0                                                               WP  8600
    XIIT = XIIT/2.0 - XMOMI**2/AIWP                                               WP  8700
    XMOMIW=XMOMIW/2.0                                                             WP  8800
    XIIL=XIIL/2.0                                                                 WP  8900
170 IF (ABS(AIWP)-.00001)210 210,180                                              WP  9000
180 IF (AIWP)220,210,190                                                          WP  9100
190 XLCF=XMID-XMOMIW/AIWP                                                         WP  9200
    IF(THETIN)200,220,200                                                         WP  9300
200 WHEEL=1.0/COSF(THETIN)                                                        WP  9400
    AIWP=AIWP*WHEEL                                                               WP  9500
    XMOMIW=XMOMIW*WHEEL                                                           WP  9600
    XIIL=XIIL*WHEEL                                                               WP  9700
    XIIT=XIIT*WHEEL**3                                                            WP  9800
    GO TO 220                                                                     WP  9900
210 XLCF=0.0                                                                      WP 10000
220 XIIL=XIIL-(XLCF**2)*AIWP                                                      WP 10100
    RETURN                                                                        WP 10200
230 STOP 99999                                                                    WP 10300
    END                                                                           WP 10400
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      FUNCTION YINT2(TEST)                                                  YI   200
      DIMENSIONA(WP3(20),AREA(8(60,20),ARFA2R(60),AREA4R(20,30),RML(20),DI   200
     1RMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(3),DISPL3(20),DI   300
     1DWL(20),H(60),HICOMP(20),HIMOO(60),HIMAR(60),HIOUT(20),HIBAO(60),HDI   400
     1RCOMP(20),ICOMP(2),JUNEAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   500
     1AME1R(8),NCOMP2(2,3,3),NP(60),PERM(18),PERM1(3)                       DI   600
      DIMENSIONPERM2(18),RAR(5,5,10),S(60,20),SPS(60),STRMIP(20),STATNO(DI   700
     160),SECTIM(20),TCRIC(20),TCRR(5,5,10),TCRIR(60,20),TCOPR(60),THETRDI   800
     1M(10),TPI(20),TRIM3(6),VCRIC(20),VCRR(5,5,10),VCRIR(60,20),VCORR(6DI   900
     10),VOL3(20),VOLR(8),VOLIC(20),WEIGHT(20),X(60),XIDAM(30),XIDAM2(18DI  1000
     1),XIDAM6(20),XPDAM6(20),XIW(20),XPDAM(30),XPDAM2(18)                  DI  1100
      DIMENSIONXPR(60),XXR(3,20),XKML(20),XKMT(20),XLIDAM(30,3),XLCRIC(20DI  1200
     1),XLCR3(20),XLCP3(20),XLCRIW(20),XLCRR(5),XMTI(20),Y(60,20),YI(60)DI  1300
     1,Z(60,20) ,YIINT(6,30),THETRM(6)                                      DI  1400
      DIMENSION XLVH(20)                                                    DI  1500
      COMMON/1/AIMA,AIWP,AIWP3,AREA(8,AREA2R,AREA4R,RML,RMT,CIA,CIALPH,CDI  1600
     11R,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIBASC,HICOMPDI  1700
     1,HRCOMP,HIMOO,HIMAR,HIOUT,HIBAO,HPMAR,HRMAR,HWI,IIAFT,IIMAL,DI  1800
     1IIFWD,IISYM,IIWC,IIWH,IIWL,IRWC,IRWH,IRWL,JUNEAK,ICOMP,ICHECK,INITDI  1900
     1,IRENTL,IRRRNO,ISTAT,ISTOP,ITEST1,ITEST2,JY,JUNEAK                    DI  2000
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHEEL,NILCODI  2100
     1,NIPERM,NITRIM,NAME,NAME1R,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2200
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERMP,RAR,S,SIRMIP,SPS,STRMIDI  2300
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRR,TCRIR,TCORR,THETIM,THETI2,THEDI  2400
     1TRT,THETRM,TPI,TRIM3,VCRIC,VCRR,VCRIR,VCORR,VOL                       DI  2500
      COMMON/3/VOLIC,VOLID,VOL3,VOLR,WAVERN,WCLING,WEIGHT,WHLINC,WHLMUL,DI  2600
     1WLLING,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPR,XRLIM,XDI  2700
     1ALIM,XTIL,XTIT,XKR,XKR3,XKML,XKMT,XLIDAM,XLMP,XLCR,XLCRIC,XLCR3,XLDI  2800
     1CP,XLCP3,XLCR,XLCRIW,XLCRR,XLMRIR,XLMRRA,XMID,XMOMIL,XMOM3V,XMTI,YDI  2900
     1,YI,YIMA,Z,WAVOC ,XIDAM6,XPDAM6,XLMRPR,IABAL                          DI  3000
      COMMON/4/IBAT,YIINT,NJHEEL,THETRM,LIMIT                               DI  3100
      DIMENSION  XIR(20),YIR(20,20),ZIR(20,20),YIRT(2,20),ZIRT(2,20),      DI   100
     1ZINT(6,10),YINT(6,10),XMLK(4),NINT(4),NPIR(20),JRPIR(20,10),         DI   200
     2JRPRT(2,10),NPIRT(2)                                                  DI   300
      COMMON XIR,YIR,ZIR,XMLK,YINT,ZINT,NPIR,NINT,YIRT,ZIRT,NPIRT,JRPIR,DI   400
     1JRPRT,INDX3,JRTAT,KRTAT,LRTAT,MRTAT,NMULK,LMULK,JCAT                  DI   500
      CALL TEST3(TEST,ZIRT)                                                 YI   600
      GO TO(5,30,40,5),K                                                    YI   700
    5 YINT2=0                                                               YI   800
      GO TO 10                                                              YI   900
   30 YINT2 = YIRT(INDX3,NWP)                                               YI  1000
      GO TO 10                                                              YI  1100
   40 DO 39  IMREA =1,10                                                    YI  1200
      IF(JRPRT(INDX3,IMREA)-NWP+1)39,99,39                                  YI  1300
   39 CONTINUE                                                              YI  1400
      L=NWP                                                                 YI  1500
      GO TO 80                                                              YI  1600
   99 IF(JRPRT(INDX3,IMREA-1)-NWP)80,81,80                                  YI  1700
   81 YINT2=YIRT(INDX3,NWP)+(YIRT(INDX3,NWP+1)-YIRT(INDX3,NWP))*(TEST-      YI  1800
     1ZIRT(INDX3,NWP))/(ZIRT(INDX3,NWP)-ZIRT(INDX3,NWP+1))                  YI  1900
      GO TO 10                                                              YI  2000
   90 L=NWP-1                                                               YI  2100
   80 Z1=ZIRT(INDX3,L)                                                      YI  2200
      Z2=ZIRT(INDX3,L+1)                                                    YI  2300
      Z3=ZIRT(INDX3,L+2)                                                    YI  2400
      CALL COEFF1(Z1,Z2,Z3,TEST)                                            YI  2500
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      YY=C1A*VIST(IND*3,L+2)+C1B*VIST(IND*3,L+1)+C1C*VIST(IND*3,L)      V1  2500
                                                                        V1  2510
   99 FORMAT(*YINT=*,F10.2,3I5/(10F10.2))                               V1  2600
      IF(YY)2000,9,9                                                    V1  2700
 2000 YY=0                                                              V1  2800
    9 YINT=YY                                                           V1  2900
   10 RETURN                                                            V1  3000
      END
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      SUBROUTINE OUTPT                                                  OU   200
      DIMENSION  KBPT1(20),KBPT2(20),HULL(3)                            OU   210
      DIMENSIONAIWP1(20),AREA1S(60,20),AREA2S(60),AREA4S(20,30),AML(20),DI   300
     1GMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOFT(20),DATE(2),DISPL1(20),DI   400
     1DWL(20),H(60),HICOMP(20),HIHOO(60),HIMAR(60),HIOUT(20),HISAG(60),HDI   500
     1ICOMP(20),ICOMP1(8),JBREAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   600
     1AME1S(8),NCOMP2(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   700
      DIMENSIONPERMP(10),RAS(9,9,10),S(60,20),SPS(60),SSSHIP(20),STATNO(DI   800
     160),SECTIM(20),TCRIC(20),TCRS(9,9,10),TCS1S(60,20),TCSPS(60),THETSDI   900
     1M(10),TPI(20),THIMI(6),VCRIC(20),VCRS(9,9,10),VCS1S(60,20),VCSPS(6DI  1000
     10),VOL1(20),VOL1S(8),VOLIC(20),WEIGHT(20),XIDAM(30),XIDAM2(10DI  1100
     1),XIDAM6(20),XPDAM6(20),XIW(20),XPDAM(30),XPDAM2(10)              DI  1200
      DIMENSIONXP9(60),XKB(20),XKML(20),XKMT(20),XLISAM(30,3),XLCBIC(20DI  1300
     1),XLCB1(20),XLCF1(20),XLCGIW(20),XLCGS(9),XMTI(20),Y(60,20),YI(60)DI  1400
     1,Z(60,20) ,YIINT(4,10),ZMPTSM(9)                                  DI  1500
      DIMENSION XLVM(20)                                                DI  1600
      COMMON/1/AIMA,AIWP,AIWP1,AREA1S,AREA2S,AREA4S,AML,AMT,CIA,CIALPH,CDI  1700
     1IW,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL1,DWL,H,HIBASC,HICOMPDI  1800
     1,HSCOMP,HIHOO,HIMAR,HIOUT,HISAG,HSMAR,HSMAR,HSMAR,HWL,IIAFT,IIMAL,DI  1900
     1IIFWD,IISYM,IIWC,IIWM,IIWL,IRWC,IRWM,IRWL,JBREAK,ICOMP,ICHECK,INITDI  2000
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDAPL,NIWEEL,NILCBDI  2200
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1TAT2,NSTAT3,NSTAT6,NWL,NWP,PERM,PERM1,PERM2,RAS,S,SISHIP,SPS,SSSHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRS,TCS1S,TCSPS,THETIM,THETI1,THEDI  2500
     1TE2,THETSM,TPI,THIMI,VCRIC,VCRS,VCS1S,VCSPS,VOL                   DI  2600
      COMMON/3/VOL1C,VOL1D,VOL3,VOL6,WAVCEN,WEIINC,WEIGHT,WWIINC,WWIMUL,DI  2700
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,XPDAM,XPDAM2,XPLIM,XPS,XSLIM,XDI  2800
     1ELIM,XIIL,XIIT,XKB,XKB2,XKML,XKMT,XLIDAM,XLWP,XLCB,XLCB1C,XLCB2,XLDI  2900
     1CF,XLCF2,XLCG,XLCGIW,XLCGS,XLMBIM,XLMBDA,XMID,XMOMIL,XMOMJV,XMTI,YDI  3000
     1Y1,YIMA,Z,WAVLOC ,XIDAM6,XPDAM6,XLMBPR,IABAL                      DI  3100
      COMMON/4/ICAT,YIINT,NJWEEL,TMPTSM,LIMIT                           DI  3200
      DIMENSION  XIB(30),YIS(20,80),ZIS(30,80),YIST(2,80),ZIST(2,80),   DI  3300
     1ZINT(4,10),YINT(4,10),XBLK(4),NINT(4),NPIS(30),JBPIS(30,10),      DI  3400
     2JBPST(2,10),NPIST(2)                                              DI  3500
      COMMON XIB,YIS,ZIS,XBLK,YINT,ZINT,NPIS,NINT,YIS1,ZIST,NPIST,JBPIS,DI  3600
     1JBPST,INDX3,JSTAT,KSTAT,LSTAT,MSTAT,NBULK,LMULK,JCAT              DI  3700
      DATA(HULL= AHOUTER ,AHINNER ,AHHULL)                              OU  3800
      COMMON /8/ JSERNO                                                 OU  3900
      DATA(IAB1R=1H ),(ISLNK=1H )                                       OU  4000
      INTR=MSTAT=1                                                      OU  4100
      LMTR = MSTAT+LSTAT-NBULK+1                                        OU  4200
 2000 FORMAT( //61X*--- SHIP OFFSETS ---*/)                             OU  4300
 2009 FORMAT(4X,*Z*7X*Y*7(6X*Z*7X*Y*)/)                                 OU  4400
 2011 FORMAT(//48X*--- COMPARIMENT OFFSETS ---*/)                       OU  4500
 1009 FORMAT (10I8)                                                     OU  4600
 1010 FORMAT (8F10.2)                                                   OU  4700
 2001 FORMAT(47X*COMPARTMENT SECTION DEFINITION*//    * NOTE- YINT= 9999OU  4800
     1DENOTES HULL INTERSECTION*/7X*ZINT= 9999 DENOTES TOP OF SHIP HULL*OU  4900
     2/7X*ZINT=-9999 DENOTES BOTTOM OF SHIP HULL*//)                    OU  5000
 2002 FORMAT(//*NOTE-  ASTERISK DENOTES BREAKPOINT*)                    OU  5100
 2004 FORMAT(3UX,F8.2,8X,F8.2)                                          OU  5200
      WRITE(6,2003) JSERNO,NAME,ISERNO,NAME1S                           OU  5300
 2003 FORMAT(*1SHIP SER. NO.*I6* SHIP NAME-*8A4*   COMP. SER. NO.*I6* COOU  5400
     1MP. NAME-*8A4,//)                                                 OU  5500
      WRITE(3,2001)                                                     OU  5600
```

```
      NPT = NINT(1)                                                     OU  1900
 2020 FORMAT(6X,XBLK,2F8.1,2(9X,XBLK,2F8.1))                            OU  2000
 2024 FORMAT(4X,2(2INT,4X,2YINT,2(7X,2INT,4X,2YINT,))                   OU  2100
      WRITE(3,2020) (XBLK(J),J=1,NBULK)                                 OU  2200
      WRITE(3,2028)                                                     OU  2300
      DO 2030 J = 1,NPT                                                 OU  2400
 2030 WRITE(3,2026) (ZINT(I,J),YINT(I,J) ,I=1,NBULK)                    OU  2500
 2026 FORMAT(2F8.1,2(3X2F8.1))                                          OU  2600
      WRITE(3,2002)                                                     OU  2700
      IPCT = 1                                                          OU  2750
      ICOUNT = 1                                                        OU  2760
  400 DO 600  ISTAT=1,LSTAT                                             OU  2800
      JSTAT=MSTAT +(ISTAT-2)*NSTAT*(IPCT-1)                             OU  2900
      KSTAT=(ISTAT-1)*LSTAT*(IPCT-1)                                    OU  3000
      NPT=NP(JSTAT)                                                     OU  3100
      IF(NPT .LT. NPIB(KSTAT))  NPT = NPIB(KSTAT)                       OU  3150
      DO 300 I=1,20                                                     OU  3200
      KAPT1(I)=IBLNK                                                    OU  3300
  300 KAPT2(I) = IBLNK                                                  OU  3400
      DO 330 I=1,10                                                     OU  3500
      IF(JBREAK(JSTAT,I)) 320,320,310                                   OU  3600
  310 JPT=JBREAK(JSTAT,I)                                               OU  3700
      KAPT1(JPT)=IASTR                                                  OU  3800
  320 IF(JBPIB(KSTAT,I))330,330,320                                     OU  3900
  324 JPT = JBPIB(KSTAT,I)                                              OU  4000
      KAPT2(JPT)=IASTR                                                  OU  4100
  330 CONTINUE                                                          OU  4200
      WRITE(6,3000)X(JSTAT), XIB(KSTAT),NULL(IPCT), NULL (3)            OU  4300
      WRITE(6,3010)(Z(JSTAT,IPT), KAPT1(IPT),Y(JSTAT,IPT),ZIB(KSTAT,IPTOU  4400
     1),KAPT2(IPT),YIB(KSTAT,IPT),IPT=1,NPT)                            OU  4500
 3000 FORMAT(*      SHIP SECTION          COMPART. SECTION*/F8.2,* FT FROU  4600
     1OM FP*F13.2,* FT FROM FP*//6X,Z*,1X,Y*,1X,Z*,1X,Y* 10XBA6)        OU  4700
 3010 FORMAT(F8.2,2X,A1,F9.2,4X,F8.2,2X,A1,F9.2)                        OU  4800
 3020 FORMAT(*1 *)                                                      OU  4900
      ICOUNT=ICOUNT+1                                                   OU  5000
      IF(ICOUNT .NE. 2)  GO TO 600                                      OU  5100
      ICOUNT=0                                                          OU  5200
      LTOT = LSTAT+JCAT                                                 OU  5250
      WRITE (61,3040)                                                   OU  5300
  600 CONTINUE                                                          OU  5400
      GO TO (670,620,630),JCAT                                          OU  5500
  620 JCAT=3                                                            OU  5600
      IPCT=2                                                            OU  5700
      GO TO 200                                                         OU  5800
  630 JCAT = 2                                                          OU  5900
  670 RETURN                                                            OU  6000
      END                                                               OU  7000
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      SUBROUTINE MODIFY(JMOD)                                           MO   200
      DIMENSIONAIWP1(20),AHEAIS(80,29),AHEAYS(80),AHEAHS(20,10),HML(20),DI   200
     1HMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   300
     1OWL(20),H(80),HICOMP(20),HIHOG(80),HIMAX(80),HIOUT(20),HISAG(80),HDI   400
     12COMP(20),ICOMP(2),JHHEAR(80,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   500
     1AME1S(8),NCOMP2(2,3,3),NP(80),PERM(18),PERM1(3)                   DI   600
      DIMENSIONPERM2(18),RAD(5,5,10),S(80,29),S2S(80),S3SHIP(20),STATNO(DI   700
     180),SECTIM(25),TCHIC(25),TCHS(5,5,10),TCOIS(80,29),TCO2S(80),THETSDI   800
     1H(10),TPI(20),THIM3(8),VCHIC(25),VCHS(5,5,10),VCOIS(80,29),VCO2S(8DI   900
     10),VOL1(20),VOL5(5),VOLIC(25),WEIGHT(25),X(80),XIDAM(30),XIDAM2(18DI  1000
     1),XIDAM3(20),X2DAM3(20),XIV(25),X2DAM(30),X2DAM2(18)              DI  1100
      DIMENSIONA2S(80),XKM1(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCHIC(25DI  1200
     1),XLCK1(20),XLCP1(20),XLCGIR(25),XLCOS(5),XMI1(20),Y(80,29),YI(80)DI  1300
     1,Z(80,29) ,YIINT(4,30),THETIM(5)                                  DI  1400
      DIMENSION XLVM(22)                                                DI  1490
      COMMON/1/AIMA,AIWP,AIWP3,AHEAIS,AHEAYS,AHEAHS,HML,HMT,CIA,CIALPH,CDI  1500
     1IM,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIHASC,HICOMPDI  1600
     1,H2COMP,HIHOG,HIMAX,HIOUT,HISAG,H2MAX,HIMAX,HHMAX,IW1,IIAPT,IIMAX,DI  1700
     1IIPVD,IISTM,IIWC,IIAM,IIWI,I2WC,I2AM,I2WL,IOKEAR,ICOMP,ICHPN9,INITDI  1800
     1,ISENTL,INERNO,ISTAT,ISTOP,ITEST,ITEST1,IV,JHHEAR                 DI  1900
      COMMON//JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NDIFF,NDISPL,NIMER,NILCONDI  2000
     1,NIPERM,NITHI,NAME,NAME1S,NCOMP1,NCOMP2,NPSTAT,NP,NSTAT,NSTAT1,NSDI  2100
     1TAT2,NSTAT3,NSTAT4,NHL,NNP,PERM,PERM1,PERM2,RAD,S,S1SHIP,S2S,SHIPDI  2200
     1,SMAGP,STATNO,SECTIM,TCHIC,TCHS,TCOIS,TCO2S,THETIM,THETI1,THETDI  2300
     12,THETHS,TPI,THIM3,VCHIC,VCHS,VCOIS,VCO2S,VOL                     DI  2400
      COMMON/3/VOL1I,VOL1D,VOL3,VOL5,WAVCRN,WCIINC,WEIGHT,WHIINC,WHIMIDDI  2500
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XI,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI  2600
     14LIM,XIIL,XI1,XKM,XKM1,XKML,XKMT,XLIDAM,XLMP,XLCH,XLCHIC,XLCH1,XLDI  2700
     1CP,XLCP1,XLCGIR,XLCIR,XLCOS,XLMID,XLMIDA,XLIDA,XMOMIL,XMOMIV,XMI1,YDI  2800
     1,YI,YIMAX,Z,WAVLOG,XIDAM3,X2DAM3,XLMID2,LWAL                       DI  2900
      COMMON/4/ICAT,YIINT,NTHETI,THETIM,LIMIT                           DI  1000
      DIMENSION  XIS(10),YIS(10,29),ZIS(10,29),YIST(2,29),ZIST(2,29),   DI   200
     1ZINT(4,10),YINT(4,10),XHLM(4),NINT(4),NPIS(10),JHPIS(10,10),     DI   300
     2JHPST(2,10),NPIST(2)                                              DI   400
      COMMON XIS,YIS,ZIS,XHLM,YINT,ZINT,NPIS,NINT,YIST,ZIST,NPIST,JHPIS,DI   500
     1JHPST,INDX,JSTAT,KSTAT,LSTAT,MSTAT,NHULK,LHULK,ICAT                DI   600
      ITMP = 0                                                          MO   499
      NPT = NPIS(JSTAT)                                                 MO   500
      DO 1000J=1,NPT                                                    MO   600
      ZIST(1,J)=ZIS(JSTAT,J)                                            MO   700
      YIST(1,J) = YIS(JSTAT,J)                                          MO   800
      YIS(JSTAT,J)=0.                                                   MO   900
 1000 ZIS(JSTAT,J) = 0.                                                 MO  1000
      NPIST(1) = NPT                                                    MO  1100
      DO 1010 J=1,10                                                    MO  1200
      JHPST(1,J) = JHPIS(JSTAT,J)                                       MO  1300
 1010 JHPIS(JSTAT,J) = 0                                                MO  1400
      GO TO(1050,1020),ICAT                                             MO  1500
 1020 INDX= JSTAT+LSTAT                                                 MO  1600
      NPT = NPIS(INDX)                                                  MO  1700
      NPIST(2) = NPT                                                    MO  1800
      DO 1030 J=1,NPT                                                   MO  1900
      ZIST(2,J)=ZIS(INDX,J)                                             MO  2000
      YIST(2,J) = YIS(INDX,J)                                           MO  2100
      YIS(INDX,J) = 0.                                                  MO  2200
 1030 ZIS(INDX,J) = 0.                                                  MO  2300
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      DO 1060 J=1,3                                                     MO  6400
      JUMPS(2,J) = JUMPS(INDX1,J)                                       MO  6500
 1060 JUMPS(INDX1,J) = 0                                                MO  6600
 1050 I=I+1                                                             MO  6700
      INT=I                                                             MO  6800
      INTI=I                                                            MO  6900
      LA=I                                                              MO  7000
      LB=I                                                              MO  7100
      LC=I                                                              MO  7200
      INDX1=1                                                           MO  7300
      INDX2=1                                                           MO  7400
      SMALL = 0.001                                                     MO  7500
      ANEAL = -0.001                                                    MO  7600
      GUNWHALE = 0.001                                                  MO  7700
      NPTS=NPTS1(INDX1)                                                 MO  7800
C                                                                       MO  7900
C  DISCARD LAST POINT IF ZINT IS SAME AS SECOND TO LAST POINT           MO  8000
      IF(ABS(ZINT(ILHULL,NPTS)-ZINT(ILHULL,NPTS-1)).LT.0.0001)          MO  8100
     * NPTS=NPTS-1                                                      MO  8200
C  LOCATE LOWEST ZINT AND SECOND INTER IN INDX2                         MO  8300
      DO 8 J=2,NPTS                                                     MO  8400
      IF(ZINT(ILHULL,J).GE.ZINT(ILHULL,I)) GO TO 10                     MO  8500
      I=J                                                               MO  8600
   10 IF(ZINT(ILHULL,J) .GE. ANEAL) GO TO 8                             MO  8700
    9 INDX2 = J                                                         MO  8800
      GO TO 11                                                          MO  8900
    8 INDX1 = J-1                                                       MO  9000
   11 LMT = INDX2                                                       MO  9100
      LMT1=INDX1                                                        MO  9200
C  DOES SHIP HAVE INNER AND OUTER HULL, YES TO 15, NO TO 19            MO  9300
      GO TO (15,19),ICNT                                                MO  9400
C                                                                       MO  9500
C  IF FIRST POINT IS ON HULL, THEN IT MUST BE ON OUTER HULL SINCE POINTS MO  9600
C  ARE TAKEN CLOCKWISE. IF IT IS NOT, TEST FURTHER                      MO  9700
C                                                                       MO  9800
   15 IF(ZINT(ILHULL,I) .GE. SMALL ) GO TO 16                           MO  9900
C                                                                       MO 10000
C  TEST DELTA ZINT OF FIRST 2 HULL INTERSECTIONS(IF 2ND HULL) IF SAME   MO 10100
C  THAN ZINT(I), INT. ON OUTER HULL. IF GREATER, ON INNER HULL.         MO 10200
C                                                                       MO 10300
      IF GO IS ZERO                                                     MO 10400
         IF(ZINT(ILHULL,J) .LT. SMALL) GO TO 16                         MO 10500
         IF(ZINT(ILHULL,I) .LE. ZINT(ILHULL,J)) GO TO 16                MO 10600
      IN INDX1=2                                                        MO 10700
         ISTAT=INDX1                                                    MO 10800
         GO TO 18                                                       MO 10900
   19 CONTINUE                                                          MO 11000
   18 NPTS=NPTS1(INDX1)                                                 MO 11100
C  IF HIGH ZINT=9999 (TOP OF SECTION), EQUATE TO ACTUAL VALUE           MO 11200
      IF(ZINT(ILHULL,INDX1) .LT.GUNWHALE) GO TO 14                      MO 11300
   17 ZINT(ILHULL,INDX1)=ZST(INDX1,NPTS)                                MO 11400
      NINR = INDX1                                                      MO 11500
   14 JMPIN(ISTAT,1)=1                                                  MO 11600
C                                                                       MO 11700
C  IF LOW ZINT=-9999 (BOTTOM OF SECTION), EQUATE TO ACTUAL VALUE        MO 11800
      IF(ZINT(ILHULL,INDX2) .GT.ANEAL) GO TO 20                         MO 11900
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      Z(S(JSTAT,I)=Z(ST(INDX),I)                                                MO  7400
      Y(S(JSTAT,I)=Y(ST(INDX),I)                                                MO  7500
      NWP=2                                                                     MO  7600
      NWP=1                                                                     MO  7700
      GO TO 29                                                                  MO  7800
   20 LP = 1                                                                    MO  7900
      GO TO 125                                                                 MO  8000
   24 L2=L2+1                                                                   MO  8100
      L9=2                                                                      MO  8200
   30 DO 500 I=INT,LMT                                                          MO  8300
      IND4=(LMT-I+1)*(L9-1)+I*(2-L9)                                            MO  8400
      IND46=IND4+1*(L9-1)-1*(2-L9)                                              MO  8500
      IF(.NOT.(Y(INT(LHULK,IND4)).GE.SHELL  .AND. (Y(INT(LHULK,IND46) .GE.SMO  8600
     1HELL .OR.Z(INT(LHULK,IND46).LE.APEXL))) GO TO 125                         MO  8700
   31 LWP = NWP                                                                 MO  8800
      LOK                                                                       MO  8900
      MONP(ST (INDX))                                                           MO  9000
      CALL TEST(Z(INT(LHULK,IND4)),Z(ST)                                        MO  9100
      LMT= NWP-LOK                                                              MO  9200
      INT= (NWP+1                                                               MO  9300
      DO 120  J=INT,LMT                                                         MO  9400
      Z(S(JSTAT,L2)=Z(ST(INDX),J)                                               MO  9500
      Y(S(JSTAT,L2)=Y(ST(INDX),J)                                               MO  9600
      L2=L2+1                                                                   MO  9700
      DO 110 N=L3,10                                                            MO  9800
      IF(JNPST(INDX,N)-J)110,111,120                                            MO  9900
  111 JNP=S(JSTAT,L4)=L2-1                                                      MO 10000
      L4=L4+1                                                                   MO 10100
  114 L3=L3+1                                                                   MO 10200
      GO TO 120                                                                 MO 10300
  115 CONTINUE                                                                  MO 10400
  120 CONTINUE                                                                  MO 10500
      IF(INT.LE.LMT) GO TO 125                                                  MO 10510
      Z(S(JSTAT,L2)=Z(INT(LHULK,IND4))+(Z(INT(LHULK,INDX))-Z(INT(LHULK,IND4MO 10520
     2))/2.0                                                                    MO 10530
      Y(S(JSTAT,L2) = Y(INT(Z(S(JSTAT,L2))                                      MO 10540
      L2 = L2 + 1                                                               MO 10550
  125 INDX9 = INDX*(2-L9)+IND4*(L9-1)                                           MO 10600
      IF(JMOD.EQ.1.OR.(N.NE.NP.0 .AND. (INDX9.EQ.1 .OR. INDX9.EQ.NP1)))         MO 10650
     1 GO TO 130                                                                MO 10700
  129 IF(ABS(Z(INT(LHULK,1)+INDX9)-Z(INT(LHULK,INDX9)))-.1)130,130,127          MO 10750
  130 Z(S(JSTAT,L2)=Z(INT(LHULK,INDX9)                                          MO 10800
      GO TO 131                                                                 MO 10850
  127 Z(S(JSTAT,L2)=(Z(INT(LHULK,1)+INDX9)-Z(INT(LHULK,INDX9)))/(XMLK(LHULK MO 10900
     2+1)-XMLK(LHULK))*(X(S(JSTAT)-XMLK(LHULK))+Z(INT(LHULK,INDX9)          MO 10950
  131 IF(Y(INT(LHULK,INDX9).LT. SHELL) GO TO 149                                MO 11000
  140 Y(S(JSTAT,L2) = Y(INT(Z(S(JSTAT,L2))                                      MO 11050
  144 GO TO (29,490),L9                                                         MO 11100
  149 GO TO (175,180),JMOD                                                      MO 11150
  175 Y(S(JSTAT,L2) = Y(INT(LHULK,INDX9)                                        MO 11200
      GO TO 144                                                                 MO 11250
  180 IF(ABS(Y(INT(LHULK,1)+INDX9)-Y(INT(LHULK,INDX9)))-.1)190,190,200          MO 11300
  190 Y(S(JSTAT,L2)=Y(INT(LHULK,INDX9)                                          MO 11350
      GO TO 144                                                                 MO 11400
  200 Y(S(JSTAT,L2)=(Y(INT(LHULK,1)+INDX9)-Y(INT(LHULK,INDX9)))/(XMLK(LHULK MO 11450
     2+1)-XMLK(LHULK))*(X(S(JSTAT)-XMLK(LHULK))+Y(INT(LHULK,INDX9)          MO 11500
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      GO TO 100                                                          MO 13010
600   JNR(S(JSTAT)=0                                                     MO 13100
      L=0(4)                                                             MO 13200
      LP=L(2)                                                            MO 13300
      IF(V(NT((NODE,(NDA)) .LT. SMALL) GO TO 500                         MO 13400
      NONE(STT(NDA))                                                     MO 13450
601   CALL TEST3(Z(T(T(NODE,(NDA)),Z(NT)                                 MO 13500
500   CONTINUE                                                           MO 13600
      NP(S(JSTAT)=L2=1                                                   MO 13700
      IF(NINF .NE. 0) Z(T(T(NODE,N(NF)=9999.0                            MO 13750
      GO TO (505,511,900),JCAT                                           MO 13800
505   GO TO (550,510),ICAT                                               MO 13810
510   JCAT=1                                                             MO 13900
      JSTAT=JSTAT+LSTAT                                                  MO 14000
      INDA=NPT                                                           MO 14100
      IF(ABS(Z(NT((NODE,(NDA2))=Z(NT((NODE,(NDA2+1))=.01)550,510,520     MO 14200
511   INDA2=INDA+1                                                       MO 14300
520   INT=INDA2+1                                                        MO 14400
      INT=INDA                                                           MO 14500
      LMT=NPT                                                            MO 14600
      L=1=NPT                                                            MO 14700
      L=0=1                                                              MO 14800
      L=2=1                                                              MO 14900
      L=3=2                                                              MO 15000
      L=4=2                                                              MO 15100
      GO TO 1(((,,,),,,)                                                 MO 15200
550   JCAT=2                                                             MO 15300
      NPT = NP(S(JSTAT)                                                  MO 15400
      GO TO 555 I=1,NPT                                                  MO 15500
      INDA = NPT+1=0                                                     MO 15600
      IF(ABS(Z(S(JSTAT+(INDA)))=.01)555,555,544                          MO 15700
554   IF(( .EQ. 1) 555,555                                               MO 15710
555   CONTINUE                                                           MO 15800
      NP(S(JSTAT)=0                                                      MO 15900
      GO TO 550                                                          MO 16000
560   IF(ABS(Z(S(JSTAT+(INDEX)))=Z(S(JSTAT+(INDA)+1))=.01)566,566,564   MO 16100
562   NP(S(JSTAT)=(INDA)                                                 MO 16200
      GO TO 550                                                          MO 16300
564   NP(S(JSTAT)=(INDA+1)                                               MO 16400
566   NPT = NP(S(JSTAT) + 1                                              MO 16410
      DO 569 I = NP(+1                                                   MO 16550
569   Z(S(JSTAT+(I)=0.0                                                  MO 16570
      RETURN                                                             MO 16600
      END                                                                MO 16700
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      SUBROUTINE OFFSET                                                 OF    400
      DIMENSION NDUMMY(99)                                              OF    201
      DIMENSIONALWP3(20),AREA1S(60,29),ANPAPS(60),AREA6S(20,30),BML(20),DI    200
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDUPT(20),DATE(2),DISPLJ(20),DI    300
     1DWL(20),H(60),HICOMP(20),HINOD(60),HIMAN(60),HIOUT(20),HISAO(60),HDI    400
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI    500
     1AME1S(8),NCOMP2(2,3,3),NP(60),PERM(10),PERM1(3)                   DI    600
      DIMENSIONPERM2(10),RAD(5,5,10),S(60,29),SPS(60),SSSHIP(20),STATNO(DI    700
     160),SECTIM(25),TCOIC(25),TCOS(5,5,10),TCOIS(60,29),TCO2S(60),THETSDI    800
     1M(10),TPI(20),THIM3(6),VCHIC(25),VCHS(5,5,10),VCOIS(60,29),VCO2S(6DI    900
     10),VOL3(20),VOL8(8),VOL1C(25),WEIGHT(25),X(60),XIDAM(30),XIDAM2(10DI   1000
     1),XIDAM6(20),X2DAM6(60),XIW(25),X2DAM(30),X2DAM6(10)              DI   1100
      DIMENSIONXPS(60),XKM3(20),XKML(20),XKMT(20),XL1DAM(30,3),XLCHIC(25DI   1200
     1),XLCHI(20),XLCP3(20),XLCOIW(25),XLCOS(5),XMTI(20),Y(60,29),YI(60)DI   1300
     1,Z(60,29),YIINT(6,10),THETJM(8)                                   DI   1400
      DIMENSION XLVM(29)                                                DI   1490
      COMMON/1/AIMA,AIWP,AIWP3,AREA1S,AREA2S,ANPA6S,BML,BMT,CIA,CIALPH,CDI   1500
     11H,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISBL,DISPL3,DWL,H,HINABC,HICOMPDI   1600
     1,H2COMP,HINOD,HIMAN,HIOUT,HISAO,HPMAN,N3MAN,N6MAN,NWL,NIAFT,NIMAL,DI   1700
     1IIFWD,IISYM,IIWC,IIWH,IIWL,I2WC,I2WH,I2WL,INBREAK,ICOMP,ICHECK,INITDI   1800
     1,ISENTL,ISENNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI   1900
      COMMON/2/JMAX,K,KM,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIMEEL,NILCGDI   2000
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI   2100
     1TAT2,NSTAT3,NSTAT6,NWL,NWP,PERM,PERM1,PERM2,RAD,S,SISHIP,SPS,SSSHIDI   2200
     1P,SPACE,STATNO,SECTIM,TCH,TCHIC,TCOS,TCOIS,TCO2S,THETIM,THETIT,THEDI   2300
     1TAT,THPTSM,TPI,THIM3,VCHIC,VCOS,VCOIS,VCO2S,VOL                   DI   2400
      COMMON/3/VOLIC,VOLID,VOL3,VOL8,WAVCFN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI   2500
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI   2600
     14LIM,XIIL,XIIT,XKB,XKB3,XKML,XKMT,XL1DAM,XLHP,XLCB,XLCBIC,XLCB3,XLDI   2700
     1CP,XLCP3,XLCO,XLCOIW,XLCOS,XLMBIM,XLMBDA,XMID,XMOMIL,XMOMJV,XMTI,YDI   2800
     1,Y1,YIMA,Z,WAVIOC,X1DAM6,X2DAM6,XLMBPR,IABAL                      DI   2900
      COMMON/4/ICAT,YIINT,NJMEEL,THETJM,LIMIT                           DI   3000
      IEOF = 999999                                                     OF   3200
      IF(INIT)1797,1794,1794                                            OF   3210
 1794 IF(ITEST1-3)1795,808,808                                          OF   3220
 1795 DO 1796 ISTAT=1,60                                                OF   3300
      DO 1796 IPOINT = 1,29                                             OF   3400
 1796 Z(ISTAT,IPOINT) = 999999.0                                        OF   3500
 1797 GO TO (5,6),ITEST1                                                OF   3600
    6 ITEST2 = ISENNO                                                   OF   3700
      GO TO 300                                                         OF   3800
    5 ITEST2 = IEOF                                                     OF   3900
      IF(INIT)300,300,130                                               OF   4000
  300 READ(30) ISENTL,NDUMMY,DUMMY2,DUMMY3,JDUMMY,LMT                   OF   4100
      IF(ISENTL-ITEST2)310,309,320                                      OF   4200
  309 BACKSPACE 30                                                      OF   4300
      IF(ITEST1-2)310,140,310                                           OF   4500
  310 BACKSPACE 30                                                      OF   4600
      READ(30) DUMMY2                                                   OF   4610
      IF(INIT)317,130,130                                               OF   4800
  320 IF (ISENTL-IEOF) 319,815,319                                      OF   4900
  319 DO 330 ISTAT = 1,LMT                                              OF   5000
  330 READ (30)DUMMY2                                                   OF   5100
      GO TO 300                                                         OF   5200
  140 READ(30)ISENTL,NAME,NSTAT,NP,XLBP,XMID,JDUMMY,LIMIT,KDUMMY        OF   5300
      DO 141 ISTAT = 1,LIMIT                                            OF   5350
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      NPOINT = NP(ISTAT)                                                    OF  5400
      READ (30)STATNO(ISTAT), X(ISTAT),(Y(ISTAT,IPOIN),Z(ISTAT,IPOINT),OF  5500
     1AREAIS(ISTAT,IPOINT),VCOIS(ISTAT,IPOINT),TCOIS(ISTAT,IPOINT),S(ISTOF  5600
     2AT,IPOINT),IPOINT =1,NPOINT),(JBREAK(ISTAT,IBREAK), IBREAK = 1,10)OF  5700
  141 HIMAR(ISTAT) = Z(ISTAT,NPOINT) - .25                                  OF  5800
      ICAT = JDUMMY                                                         OF  5900
      IISYM = KDUMMY                                                        OF  6000
      GO TO 7                                                               OF  6100
  130 DO 11 I = 1,8                                                         OF  6200
   11 NAME(I) = NAMEIS(I)                                                   OF  6300
      DO 12 ISTAT = 1,60                                                    OF  6400
      NP(ISTAT) = 0                                                         OF  6500
      DO 12 IBREAK = 1,10                                                   OF  6600
   12 JBREAK(ISTAT,IBREAK) = 0                                              OF  6700
      ISTAT = 1                                                             OF  6800
      READ (5,1)SPACE, ZSCALE, YSCALE                                       OF  6900
      ZSCALE = ZSCALE*200.0                                                 OF  7000
      IF(ABS(YSCALE)-0.00001) 9144,9144,9143                                OF  7100
 9143 YSCALE=YSCALE*200.0                                                   OF  7200
      GO TO 10                                                              OF  7300
 9144 YSCALE = ZSCALE                                                       OF  7400
   10 IZ=1                                                                  OF  7500
      JBREAK(ISTAT,1) = 1                                                   OF  7600
      IBREAK = 2                                                            OF  7700
   20 READ(5,2)STATNO(ISTAT),Y(ISTAT,IZ),Z(ISTAT,IZ),ITEST1                 OF  7800
      Y(ISTAT,IZ) = Y(ISTAT,IZ)/YSCALE                                      OF  7900
      Z(ISTAT,IZ) = Z(ISTAT,IZ)/ZSCALE                                      OF  8000
      IF(ABS(Y(ISTAT,IZ))-1.)4266,4266,4267                                 OF  8100
 4266 Y(ISTAT,IZ) = 0.0                                                     OF  8200
C     IS THIS THE FIRST POINT ON THE STATION                                OF  8300
 4267 IF (IZ-2) 25,25,30                                                    OF  8400
C     IS THIS POINT FURTHER THAN A BREAKPOINT                               OF  8500
   25 IF(ITEST1)32,35,30                                                    OF  8600
C     IS THE LAST POINT AN INSERT                                           OF  8700
   32 IF(Z(ISTAT,IZ-1)-999999.0) 66,44,66                                   OF  8800
   66 M=IZ-1                                                                OF  8900
      GO TO 61                                                              OF  9000
   44 M=IZ-2                                                                OF  9100
   61 IF(Z(ISTAT,IZ)-Z(ISTAT,M)-ABS( Y(ISTAT,IZ)-Y(ISTAT,M))/200.0)80,80,OF  9200
     1,31                                                                   OF  9300
   80 IF(IZ-2)    20,81,20                                                  OF  9400
   81 Y(ISTAT,IZ-1) = Y(ISTAT,IZ)                                           OF  9500
      Z(ISTAT,IZ-1) = Z(ISTAT,IZ)                                           OF  9600
      GO TO 20                                                              OF  9700
C     TEST IF LAST POINT IS AN INSERT                                       OF  9800
   30 IF (Z(ISTAT,IZ-1) - 999999.0) 701,710,701                             OF  9900
C     TEST IF LAST POINT IS A BREAKPOINT                                    OF 10000
  701 IF (JBREAK(ISTAT,IBREAK-1) - (IZ-1)) 702,710,702                      OF 10100
C     TEST IF THE SLOPE OF A LINE BETWEEN THE LAST  POINT AND THIS POINT    OF 10200
C     IS GREATER THAN .005                                                  OF 10300
  702 IF (Z(ISTAT,IZ) - Z(ISTAT,IZ-1) - ABS( Y(ISTAT,IZ) - Y(ISTAT,IZ-1))OF 10400
     1) / 200.0) 703,703,710                                                OF 10500
C     REPLACE THE LAST POINT WITH THIS POINT                                OF 10600
  703 Z(ISTAT,IZ-1) = Z(ISTAT,IZ)                                           OF 10700
      Y(ISTAT,IZ-1) = Y(ISTAT,IZ)                                           OF 10800
      Z(ISTAT,IZ) = 999999.0                                                OF 10900
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      IZ = IZ - 1                                                       OF 11000
C     TEST OFFSET STATUS INDICATOR                                      OF 11100
  710 IF (ITEST) - 77777) 32,72,71                                      OF 11200
   72 JBREAK(ISTAT,IBREAK) = IZ                                         OF 11300
      IBREAK = IBREAK + 1                                               OF 11400
      IF((IZ/2)*2 - IZ)31,13,31                                         OF 11500
   13 IZ = IZ + 2                                                       OF 11600
      GO TO 20                                                          OF 11700
C     TEST THE OFFSET STATUS INDICATOR                                  OF 11800
   25 IF (ITEST) 32,11,26                                               OF 11900
   26 IF (ITEST - 77777) 32,31,27                                       OF 12000
   27 IF (ITEST - 88888) 32,40,28                                       OF 12100
   28 IF (ITEST - 99999) 32,61,32                                       OF 12200
C     ADD ONE TO POINT INDEX                                            OF 12300
   31 IZ = IZ + 1                                                       OF 12400
      GO TO 20                                                          OF 12500
   71 IF(ITEST - 88888)32,40,80                                         OF 12600
   40 JBREAK(ISTAT,IBREAK) = IZ                                         OF 12700
   42 NP(ISTAT) = IZ                                                    OF 12800
      HIMAR(ISTAT) = Z(ISTAT,IZ)-.25                                    OF 12900
      X(ISTAT)=STATNO(ISTAT)*SPACE1                                     OF 13000
  722 ISTAT = ISTAT + 1                                                 OF 13100
      GO TO 10                                                          OF 13200
   80 IF(ITEST) - 99999) 32,81,32                                       OF 13300
   81 JBREAK(ISTAT,IBREAK) = IZ                                         OF 13400
   82 NP(ISTAT) = IZ                                                    OF 13500
      NSTAT=ISTAT                                                       OF 13600
      X(ISTAT)=STATNO(ISTAT)*SPACE1                                     OF 13700
      HIMAR(ISTAT) = Z(ISTAT,IZ)-.25                                    OF 13800
      IF(ICAT-2)333,334,335                                             OF 13900
  334 ICAT = 3                                                          OF 14000
      ISTAT = ISTAT + 1                                                 OF 14100
      LIMIT = 2*NSTAT                                                   OF 14200
      GO TO 10                                                          OF 14300
  335 ICAT = 2                                                          OF 14400
      NSTAT = NSTAT/2                                                   OF 14500
      GO TO 344                                                         OF 14600
  333 LIMIT = NSTAT                                                     OF 14700
  344 DO 411 ISTAT = 1,LIMIT                                            OF 14800
      IF(NP(ISTAT)-49)7823,7823,7824                                    OF 14900
 7824 WRITE(6,806) (NAME(I),I=1,N),ISENNO,(DATP(I), I=1,2)              OF 15000
      WRITE(6,7825) NP(ISTAT),STATNO(ISTAT)                             OF 15100
      ISTOP = 1                                                         OF 15200
      GO TO 411                                                         OF 15300
 7825 FORMAT(1X,I3,18H POINTS ON STATION=F8.3, 8H. THE MAXIMUM ALLOWED IOF 15400
     1S 99 - SEE INPUT INSTRUCTIONS/48H I CANNOT CHECK SLOPE BETWEEN BREOF 15500
     2AKPOINTS ON THIS STATION )                                        OF 15600
 7823 DO 41 IBREAK = 2,10                                               OF 15700
      JBRK1 = JBREAK(ISTAT,IBREAK)                                      OF 15800
      JBRK2 = JBREAK(ISTAT,IBREAK-1)                                    OF 15900
      IF(JBRK1-1)41),411,723                                            OF 16000
  723 IF(Z(ISTAT,JBRK1)-Z(ISTAT,JBRK2 ) - ABS( Y(ISTAT,JBRK1)-Y(ISTAT,JBOF 16100
     1RK2 ))/200.0)92,92,41                                             OF 16200
   41 CONTINUE                                                          OF 16300
  411 CONTINUE                                                          OF 16400
      IF(INIT)5100,6000,6000                                            OF 16500
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   92 WRITE (6,806)(NAME(I),I=1,8),ISERNO,(DATE(I),I=1,2)                    OF 16600
      WRITE (6,93)STATNO(ISTAT),Z(ISTAT,JBRK)                                OF 16700
   93 FORMAT(19H THE SHIP HAS A FLAT BOTTOM AT STATION F8.3,12H AND A Z OF   OF 16800
     1OF F8.3,22H FT. ABOVE THE BASELINE/47H THIS IS ILLEGAL-CANNOT PROCOF   OF 16900
     2EED. CHECK INPUT INSTRUCTIONS)                                         OF 17000
      ISTOP = 1                                                              OF 17100
      IF(INIT)9170,6000,6000                                                 OF 17110
 6000 READ (5,7)XLNP                                                         OF 17200
      XMID = XLNP/2.0                                                        OF 17300
      WRITE (6,806)(NAME(I), I=1,8), ISERNO, (DATE(I), I = 1,2)              OF 17400
      WRITE (6,4000)                                                         OF 17500
      WRITE (6,9000)                                                         OF 17600
 4000 FORMAT( 30H1TABLE OF OFFSETS - INPUT DATA/                             OF 17700
     1 21H THE FOLLOWING PAGE$ CONTAIN THE OFFSETS AS SUBMITTED IN THE DOF   OF 17800
     2ATA DECK./ 24H BREAKPOINTS(SEE INPUT INSTRUCTIONS) ARE INDICATED BOF   OF 17900
     3Y THE WORD BREAKPOINT.                                                 OF 18000
     4  /  47H THIS TABLE IS THE OUTPUT OF SUBROUTINE OFFSET.   //)         OF 18100
 9000 FORMAT(18H DEFINITIONS AND UNITS ARE AS FOLLOWS./  35H Z - HEIGHT      OF 18200
     1 IN FEET ABOVE BASELINE  / 28H Y - HALF BREADTH IN FEET )              OF 18300
      WRITE (6,806)(NAME(I),I=1,8),ISERNO,(DATE(I), I=1,2)                   OF 18400
  806 FORMAT(6H1SHIP-6X8A6,9X16HSERIAL NUMBER-I6,9XBHDATE=2A6/)              OF 18500
      WRITE (6,800)                                                          OF 18600
  800 FORMAT(28HOTABLE OF OFFSETS-INPUT DATA//)                              OF 18700
      KCOUNT = 0                                                             OF 18800
      DO 881 ISTAT = 1,LIMIT                                                 OF 18900
      NPOINT = NP(ISTAT)                                                     OF 19000
      KCOUNT = KCOUNT + 1 + NPOINT                                           OF 19100
      IF(KCOUNT - 60)850,850,849                                             OF 19200
  849 KCOUNT = 9 + NPOINT                                                    OF 19300
      WRITE (6,806)(NAME(I) , I = 1,8), ISERNO, (DATE(I), I = 1,2)           OF 19400
      WRITE (6,800)                                                          OF 19500
  850 IBREAK = 1                                                             OF 19600
      WRITE (6,866)STATNO(ISTAT), X(ISTAT)                                   OF 19700
  866 FORMAT(8HOSTATION=F7.3,2X,7HLOCATED=F8.2,11H FT FROM FP/8X1HZ10X1HY)   OF 19800
  860 M1 = JBREAK(ISTAT,IBREAK)                                              OF 19900
  868 M2 = JBREAK(ISTAT,IBREAK+1)-1                                          OF 20000
      IF( M2-1)      9217,810,9217                                           OF 20100
 9217 IF(M1-M2)    810,819,819                                              OF 20200
  810 WRITE (6,801)(Z(ISTAT,IPOINT),Y(ISTAT,IPOINT), IPOINT = M1,M2)         OF 20300
  801 FORMAT(2F10.2)                                                         OF 20400
  819 IF(JBREAK(ISTAT,IBREAK+1)-NP(ISTAT))820,8911,820                       OF 20500
  820 WRITE (6,8011)Z(ISTAT,M2+1),Y(ISTAT,M2+1)                              OF 20600
 8011 FORMAT(2F10.2, 12H  BREAKPOINT)                                        OF 20700
      IBREAK = IBREAK + 1                                                    OF 20800
      M1 = JBREAK(ISTAT,IBREAK) +1                                           OF 20900
      IF(ABS( Z(ISTAT,M1)-999999.0)-0.0001) 847,847,848                      OF 21000
  847 M1 = M1 + 1                                                            OF 21100
      GO TO 868                                                              OF 21200
 8911 WRITE (6,801)Z(ISTAT,M2+1),Y(ISTAT,M2+1)                               OF 21300
  881 CONTINUE                                                               OF 21400
      IF (ISTOP-1) 9140,809,9150                                             OF 21500
 9140 CALL TABLE                                                             OF 21600
      DO 9163 I = 1,LIMIT                                                    OF 21601
      INT = NP(I)+1                                                          OF 21602
      DO 9163 J = INT,20                                                     OF 21603
 9163 Z(I,J) = 0.                                                            OF 21604
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      WRITE (30)ISERNO,(NAME(I),I=1,8),NSTAT,(NP(ISTA),ISTAT=1,60   ),XOF 21700
     1LRP,XMID,ICAT,LIMIT,IISYM                                        OF 21800
      DO 190 ISTAT = 1,LIMIT                                           OF 21900
      NPOINT = NP(ISTAT)                                               OF 22000
  190 WRITE (30)STATNO(ISTAT), X(ISTAT),(Y(ISTAT,IPOINT),Z(ISTAT,IPOINT)OF 22100
     1,AREAIS(ISTAT,IPOINT),VCGIS(ISTAT,IPOINT),TCGIS(ISTAT,IPOINT),BIISOF 22200
     2TAT,IPOINT),IPOINT =1,NPOINT),(JBREAK(ISTAT,IBREAK), IBREAK = 1,100F 22300
     3)                                                                OF 22400
      WRITE (30)IEOF   ,(NAME(I),I=1,8),NSTAT,(NP(ISTAT),ISTAT=1,60   ),XOF 22500
     1LRP,XMID,ICAT,LIMIT,IISYM                                        OF 22600
    7 NNSTAT = NSTAT-1                                                 OF 22700
      GO TO 9174                                                       OF 22709
 9171 DO 9172  I=1,8                                                   OF 22710
 9172 NAME(I) = NAMEIS(I)                                              OF 22720
      GO TO 144                                                        OF 22760
 9174 IF(IK) 809,808,805                                               OF 22800
  808 WRITE (6,806)(NAME(I),I=1,8),ISERNO,(DATE(I),I=1,2)              OF 22900
      WRITE (6,1000)                                                   OF 23000
      WRITE (6,2000)                                                   OF 23100
 1000 FORMAT(1HI,3SHIP DATA TABLE /                                    OF 23200
     1/100H THE FOLLOWING PAGES CONTAIN THE SHIP DATA TABLE OF INTERPOLAOF 23300
     2TED OFFSETS AND COMPUTED SECTIONAL AREAS, VCGS, / 90H HALF SECTIONOF 23400
     3 TCGS, AND HALF SECTION GIRTHS.  THE TABLE IS THE OUTPUT OF SUBROUOF 23500
     4TINE TABLE. // 18H DEFINITIONS AND UNITS ARE AS FOLLOWS. /       OF 23600
     5 41H Z - HEIGHT IN FEET ABOVE BASELINE       / 32H Y - HALF BREADTOF 23700
     6H IN FEET       /41H AREAS - FULL SECTION AREA IN SQUARE FEET/)  OF 23800
 2000 FORMAT(29H VCGS - VERTICAL CENTER OF GRAVITY OF SECTION AREA ABOVEOF 23900
     1 BASELINE IN FT.       /29H TCG - TRANSVERSE CENTER OF GRAVITY OF OF 24000
     2HALF SECTION AREA MEASURED FROM THE CENTERLINE IN FT./36H GIRTH = OF 24100
     3HALF SECTION GIRTH IN FT./)                                      OF 24200
      WRITE (6,806)(NAME(I),I = 1,8),ISERNO,(DATE(I), I = 1,2)         OF 24300
      WRITE (6,804)                                                    OF 24400
  804 FORMAT( 93HOTABLE OF INTERPOLATED OFFSETS AND COMPUTED SECTIONAL AOF 24500
     1REAS,VCGS,GIRTH, AND HALF SECTION TCGS//)                        OF 24600
      KCOUNT = 0                                                       OF 24700
      DO 860 ISTAT = 1,LIMIT                                           OF 24800
      NPOINT = NP(ISTAT)                                               OF 24900
      KCOUNT = KCOUNT + 3 + NPOINT                                     OF 25000
      IF(KCOUNT - 60)860,860,859                                       OF 25100
  859 KCOUNT = 0 + NPOINT                                              OF 25200
      WRITE (6,806)(NAME(I) , I = 1,8), ISERNO, (DATE(I), I = 1,2)     OF 25300
      WRITE (6,804)                                                    OF 25400
  860 WRITE (6,803)STATNO(ISTAT), X(ISTAT),(Z(ISTAT,IPOINT),Y(ISTAT,IPOIOF 25500
     1NT),AREAIS(ISTAT,IPOINT),VCGIS(ISTAT,IPOINT),TCGIS(ISTAT,IPOINT),BOF 25600
     2(ISTAT,IPOINT),IPOINT = 1,NPOINT)                                OF 25700
  803 FORMAT(8HOSTATION,F7.3,2X,                                       OF 25800
     1                  7HLOCATED,F8.2,11H FT FROM FP/6X1HZ10X1HY9X4HAROF 25900
     2EA6X3HVCG7X3HTCG4X10H  GIRTH   /(4F10.3))                        OF 26000
    1 FORMAT(F10.2)                                                    OF 26100
    2 FORMAT(3F10.3)                                                   OF 26200
    3 FORMAT(F6.3,2F7.0,16)                                            OF 26300
  809 REWIND 10                                                        OF 26400
      RETURN                                                           OF 26500
  815 WRITE (6,806)(NAME(I), I = 1,8), ISERNO, (DATE(I), I = 1,2)      OF 26600
      WRITE (6,816)                                                    OF 26700
      GO TO 9170                                                       OF 26800
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816 FORMAT (20H0SHIP IS NOT ON SHIP DATA TAPE, RUN WILL BE TERMINATEDOF 26900
    1.)                                                              OF 27000
 39 WRITE (6,806)(NAME(I), I = 1,8), ISERNO, (DATE(I), I = 1,2)      OF 27100
    WRITE (6,4)                                                      OF 27200
  4 FORMAT(102H END CODE OF OFFSET CARD OTHER THAN  BLANKS, 00000, 777OF 27300
    177, 88888, OR 99999, CANNOT PROCEED, CHECK DATA)                OF 27400
5170 ITEST1 = 567                                                    OF 27500
     REWIND 10                                                       OF 27510
     RETURN                                                          OF 27600
     END                                                             OF 27700
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      SUBROUTINE SECTN                                                  SE   200
      DIMENSIONA1WP3(20),AMFA1S(60,29),AMFA2S(60),AMFA4S(20,30),AML(20),DI   300
     1AMT(20),C1ALPH(20),C1P(60),C1WP(20),C1DOFT(20),UATF(2),DISPL3(20),DI   400
     1OWL(20),H(60),HICOMP(20),HIMOD(60),HIMAR(60),HIOUT(20),HISAG(60),HDI   500
     12COMP(20),ICOMP(2),JMHEAK(60,10),JMAX(3),KMAX(20,3),KP(8),NAME(8),NDI   600
     1AME1S(8),NCOMP3(2,3,3),NP(60),PERM(18),PERM1(3)                   DI   700
      DIMENSIONPERM2(18),RAS(5,5,10),S(60,29),S2S(60),S3SHIP(20),STATNO(DI   800
     160),SECTIM(29),TCHIC(29),TCS3(5,5,10),TCOIS(60,29),TCO2S(60),THETSDI   900
     1M(10),TPI(20),TRIM3(6),VCHIC(29),VCHS(5,5,10),VCOIS(60,29),VCO2S(6DI  1000
     10),VOL3(20),VOL5(5),VOLIC(29),WEIGHT(29),X(60),XIDAM(30),XIDAM2(18DI  1100
     1),XIDAM4(20),X2DAM4(20),XIW(29),X2DAM(30),X2DAM2(18)              DI  1200
      DIMENSIONX2S(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCB1C(29DI  1300
     1),XLCR3(20),XLCP3(20),XLCOIW(29),XLCOS(5),XMTI(20),Y(60,29),YI(60)DI  1400
     1,Z(60,29) ,YIINT(4,30),IMPT3M(5)                                  DI  1500
      DIMENSION XLVH(29)                                                DI  1600
      COMMON/1/AIMA,AIWP,AIWP3,AMLA15,AMFA29,AMFA4S,AML,AMT,C1A,C1ALPH,CDI  1700
     11H,C1C,C1P,C1DOFT,C1WP,CONST,DATF,DISPL,DISPL3,DWL,H,HIMAHC,HICOMPDI  1800
     1,H2COMP,HIMOD,HIMAH,HIOUT,HISAG,H2MAR,H3MAR,H4MAR,HW1,IIAFT,IIMAL,DI  1900
     1IIFWD,IISYM,IIWC,IIWH,IIWL,I2WC,I2WH,I2WL,JHHEAK,ICOMP,ICHECK,INITDI  2000
     1,ISENTL,ISERNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIOSPL,NIHPPL,NILCODI  2200
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAS,S,S1SHIP,S2S,S3SHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCH,TCHIC,TCS3,TCOIS,TCO2S,THETIM,THETIT,THEDI  2500
     1TAT,THETSM,TPI,TRIM3,VCHIC,VCHS,VCOIS,VCO2S,VOL                   DI  2600
      COMMON/3/VOL1C,VOL1D,VOL3,VOL5,WAVCRN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2700
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI  2800
     14LIM,XIIL,XIIT,XKR,XKR3,XKML,XKMT,XLIDAM,XLBP,XLCR,XLCR1C,XLCR3,XLDI  2900
     1CF,XLCP3,XLCQ,XLCOIW,XLCOS,XLMHIH,XLMRDA,XMID,XMOMII,XMOM3V,XMTI,YDI  3000
     1,YI,YIMA,Z,WAVLOC ,X1DAM4,X2DAM4,XLMRDH,IAMAL                     DI  3100
      COMMON/4/ICAT,YIINT,NJHEEL,IMPT3M,LIMIT                           DI  3200
      DIMENSION  XIB(30),YIS(30,29),ZIS(30,29),YIST(2,29),ZIST(2,29),   DI  3300
     1ZINT(4,10),YINT(4,10),XWLK(4),NINT(4),NPIS(30),JBPIS(30,10),      DI  3400
     2JBPST(2,10),NPIST(2)                                              DI  3500
      COMMON XIB,YIS,ZIS,XWLK,YINT,ZINT,NPIS,NINT,YIST,ZIST,NPIST,JBPIS,DI  3600
     1JBPST,INDX3,JSTAT,KSTAT,LSTAT,MSTAT,NWULK,LWULK,JCAT              DI  3700
      FLINT(YA,YB,XA,XB,XI)=YA+(YB-YA)*(XI-XA)/(XB-XA)                  SE  3800
C                                                                       SF  3900
C         FIND CLOSEST SHIP STATION TO COMPARTMENT STATION JSTAT        SE  4000
      LIM=NSTAT-1                                                       SE  4100
      DO 10 JW=1,LIM                                                    SF  4200
      DIS=(X(JW+1)-X(IS(JSTAT)))/(XIS(JSTAT)-X(JW))                     SE  4300
C         IF COMPARTMENT AND BULKHEAD IS A SHIP STATION STORE PARA-     SF  4400
C         METERS AND RETURN                                             SF  4500
      IF(ABS(DIS)-.1)5,15,9                                             SE  4600
    5 IF(DIS) 10,15,20                                                  SE  4700
   10 CONTINUE                                                          SE  4800
C                                                                       SE  4900
   15 ISTAT=KSTAT                                                       SF  5000
      KSTAT=JW+1                                                        SE  5100
      CALL STORE                                                        SF  5200
      KSTAT=ISTAT                                                       SF  5300
      GO TO(250,225,240),ICAT                                           SF  5400
C         TO WHICH SHIP STATION IS COMPARTMENT STATION CLOSEST          SF  5500
   20 IF(DIS-1.) 40,40,30                                               SE  5600
   30 NCLOS=JW                                                          SE  5700
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      NPAR=JW+1                                                          SE  2400
      GO TO 80                                                           SE  2500
   60 NCLOS=JW+1                                                         SE  2600
      NPAR=JW                                                            SE  2700
C                                                                        SE  2800
C          INTERPOLATE BULKHEAD(COMPARTMENT STATION)KEEL HEIGHT          SE  2900
C          AND KEEL OFFSET.                                              SE  2910
C                                                                        SE  2920
   80 Z(S(JSTAT+1))=F(INTZ(NCLOS+1),Z(NPAR+1),X(NCLOS),X(NPAR),         SE  3000
     1X(S(JSTAT+1))                                                      SE  3100
      Y(S(JSTAT+1))=F(INTY(NCLOS+1),Y(NPAR+1),X(NCLOS),X(NPAR),         SE  3110
     1X(S(JSTAT+1))                                                      SE  3120
C                                                                        SE  3200
C          CHECK ORDER OF NEIGHBORING STATIONS                           SE  3300
      IF(NCLOS-NPAR) 85,95,70                                            SE  3400
C          NEIGHBOR STATION IS FIRST,LAST OR DOUBLE STATION              SE  3500
   85 IF(NCLOS-1) 87,60,87                                               SE  3600
   87 IF(X(NCLOS)-X(NCLOS-1))88,90,98                                    SE  3700
   88 N1=NCLOS-1                                                         SE  3800
      M1=N1                                                              SE  3900
      N2=NCLOS                                                           SE  4000
      N1=NPAR                                                            SE  4100
      M2=N1                                                              SE  4200
      GO TO 110                                                          SE  4300
   90 IF(X(NPAR)-X(NPAR+1)) 60,100,95                                    SE  4400
   95 N1=NCLOS                                                           SE  4500
      N2=NPAR                                                            SE  4600
      M1=N2                                                              SE  4700
      N1=NPAR+1                                                          SE  4800
      M2=N1                                                              SE  4900
      GO TO 110                                                          SE  5000
   70 IF(NCLOS-NSTAT) 74,80,74                                           SE  5100
   74 IF(X(NCLOS)-X(NCLOS+1))77,80,77                                    SE  5200
   77 N1=NPAR                                                            SE  5300
      M1=N1                                                              SE  5400
      N2=NCLOS                                                           SE  5500
      N3=NCLOS+1                                                         SE  5600
      M2=N3                                                              SE  5700
      GO TO 110                                                          SE  5800
   80 IF(X(NPAR)-X(NPAR-1))85,90,85                                      SE  5900
   85 N1=NPAR-1                                                          SE  6000
      M1=N1                                                              SE  6100
      N2=NPAR                                                            SE  6200
      M2=N2                                                              SE  6300
      N1=NCLOS                                                           SE  6400
      GO TO 110                                                          SE  6500
   90 N1=NCLOS                                                           SE  6600
      N2=NPAR                                                            SE  6700
      GO TO 160                                                          SE  6800
  100 N1=NPAR                                                            SE  6900
      N2=NCLOS                                                           SE  7000
      GO TO 160                                                          SE  7100
C                                                                        SE  7200
C          NORMAL CASE.  QUADRATIC INTERPOLATION OF INTERMEDIATE OFFSETS.SE  7300
C          FIND FIRST POINT OF CLOSEST STATION WITH DRAFT GREATER THAN   SE  7400
C          DRAFT OF FIRST POINTS OF BOTH NEIGHBORING STATIONS.           SE  7500
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  110 NPT=NP(NCLOS)                                                    SE  7600
      DO 120 JJST=1,NPT                                                SE  7700
      IF(Z(NCLOS,JJST)-Z(M1,1)) 120,120,115                            SE  7800
  115 IF(Z(NCLOS,JJST)-Z(M2,1)) 120,120,130                            SE  7900
  120 CONTINUE                                                         SE  8000
  130 CALL CORFIT(X(N1),X(N2),X(N3),XIS(JSTAT))                        SE  8100
      C2A=C1A                                                          SE  8120
      C2B=C1B                                                          SE  8140
      C2C=C1C                                                          SE  8160
                                                                       SE  8200
C                                                                      SE  8300
C         FOR EACH POINT ON CLOSEST STATION FIND OFFSETS OF POINTS AT  SE  8400
C         THE SAME DRAFT ON NEIGHBORING STATIONS.                      SE  8500
C                                                                      SE  8600
C         USE THESE THREE POINTS TO INTERPOLATE AN OFFSET ON THE INTER-SE  8700
C         MEDIATE COMPARTMENT STATION.                                 SE  8800
C                                                                      SE  8900
      DO 150 JL=JJST,NPT                                               SE  9000
      JJ=JL-JJST+2                                                     SE  9100
      DO 140 ISTAT=N1,N3                                               SE  9200
      M(ISTAT)=Z(NCLOS,JL)                                             SE  9300
  140 CALL WPLAN1                                                      SE  9400
      ZIS(JSTAT,JJ)=Z(NCLOS,JL)                                        SE  9500
  150 YIS(JSTAT,JJ)=C2A*Y1(N3)+C2B*Y1(N2)+C2C*Y1(N1)                   SE  9600
      GO TO 210                                                        SE  9700
C                                                                      SE  9800
C         EXCEPTIONAL CASE.  ONLY TWO STATIONS AVAILABLE FOR INTERPOLA-SE  9900
C         TION.  USE LINEAR INTERPOLATION.                             SE 10000
C                                                                      SE 10100
  160 NPT=NP(NCLOS)                                                    SE 10200
C                                                                      SE 10300
C         FIND FIRST POINT ON CLOSE STATION WITH DRAFT GT DRAFT OF FIRSTSE 10400
C        POINT ON DISTANT STATION.                                     SE 10500
C                                                                      SE 10600
      DO 170 JJST=1,NPT                                                SE 10700
      IF(Z(NCLOS,JJST)-Z(NFAR,1))170,170,180                           SE 10800
  170 CONTINUE                                                         SE 10900
C                                                                      SE 11000
C         FOR EACH POINT ON CLOSE STATION FIND OFFSET ON DISTANT STA-  SE 11100
C         TION USE THESE OFFSETS TO INTERPOLATE.                       SE 11200
C                                                                      SE 11300
  180 DO 200 JL=JJST,NPT                                               SE 11400
      JJ=JL-JJST+2                                                     SE 11500
      DO 190 ISTAT=N1,N2                                               SE 11600
      M(ISTAT)=Z(NCLOS,JL)                                             SE 11700
  190 CALL WPLAN1                                                      SE 11800
      ZIS(JSTAT,JJ)=Z(NCLOS,JL)                                        SE 11900
  200 YIS(JSTAT,JJ)=PLINT(Y1(N1),Y1(N2),X(N1),X(N2),XIS(JSTAT))        SE 12000
C                                                                      SE 12100
C         STORE BREAKPOINT TABLE FROM NEAREST STATION IN JBPIS         SE 12200
C                                                                      SE 12210
      JBPIS(JSTAT,1) = 1                                               SE 12300
  210 DO 220 IBRK = 2,10                                               SE 12400
  220 JBPIS(JSTAT,IBRK)= JBREAK(NCLOS ,IBRK) - JJST + 2                SE 12500
      NPIS(JSTAT) = NP(NCLOS) - JJS. + 2                               SE 12600
  225 IF(ICAT-2) 250,230,240                                           SE 12700
  230 ICAT=3
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      JSTAT=LSTAT*JSTAT                                                 SE 12800
      KSTAT=NSTAT*KSTAT                                                 SE 12900
      JW=JW*NSTAT                                                       SE 13000
      GO TO 9                                                           SE 13100
  240 JSTAT=JSTAT-LSTAT                                                 SE 13200
      KSTAT=KSTAT-NSTAT                                                 SE 13300
      ICAT=2                                                            SE 13400
  290 RETURN                                                            SE 13500
      END                                                               SE 13600
```

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      SUBROUTINE STORE                                                  ST    200
      DIMENSIONA(WP(20),AREA(S(60,99),ARFA2S(60),ARFA4S(20,30),HML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDUFT(20),DATE(2),DISPLJ(20),DI   400
     1DWL(20),H(60),HICOMP(20),HIMON(60),HIMAH(60),HIOUT(20),HISAO(60),HDI   500
     2COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   600
     1AME1S(8),NCOMP$(2,3,3),NP(60),PERM(1A),PERM1(3)                   DI   700
      DIMENSIONPERM2(1A),RAB(9,9,10),S(AO,29),SPS(60),STAGHIP(20),STATNO(DI   800
     160),SECTIM(25),TCRIC(25),TCRS(9,9,10),TCQ1S(60,29),TCQ2S(60),THETSDI   900
     1M(10),TPI(20),TRIM3(6),VCRIC(25),VCRS(9,9,10),VCQ1S(60,29),VCQ2S(6DI  1000
     10),VOLJ(20),VOLS(6),VOLIC(25),WEIGHT(25),X(60),XIDAM(30),XIDAM2(1ADI  1100
     11),XIDAM6(20),X2DAM6(20),XIW(29),X2DAM(30),X2DAM2(1A)             DI  1200
      DIMENSIONXPS(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCRIC(25DI  1300
     1),XLCR3(20),XLCP3(20),XLCQIW(25),XLCQW(5),XMTT(20),Y(60,29),Y1(60)DI  1400
     1,Z(60,99) ,YIINT(4,30),THETJM(5)                                  DI  1500
      DIMENSION XLVR(25)                                                DI  1600
      COMMON/1/AIMA,AIWP,AIWP3,AREAIS,AREA2S,ARFA6S,BML,BMT,CIA,CIALPH,CDI  1700
     1IM,CIC,CIP,CIDOFT,CIWP,CONST,DATE,DISPL,DISPL1,DWL,H,HIMABC,HICOMPDI  1800
     1,HSCOMP,HIMOD,HIMAH,HIOUT,HISAO,HSMAH,HJMAH,HSMAN,HWL,IIAFT,IIBAL,DI  1900
     1IIFWD,IISYM,IIWC,IIWH,IIWL,I2WC,I2WH,I2WL,IHMEAK,ICOMP,ICMPK9,INITDI  2000
     1,ISENTL,ISPERNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK               DI  2100
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHERL,NILCODI  2200
     1,NIPERM,NITRIM,NAME,NAMEIS,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI  2300
     1TAT2,NSTAT3,NSTAT6,NWL,NWP,PERM,PERM1,PERM2,RAB,S,SISHIP,SPS,STJBHIDI  2400
     1P,SPACE,STATNO,SECTIM,TCR,TCQIC,TCRS,TCQ1S,TCQ2S,THETIM,THETIT,THEDI  2500
     1T2T,THETSM,TPI,TRIM3,VCRIC,VCRS,VCQ1S,VCQ2S,VOL                   DI  2600
      COMMON/3/VOLIC,VOLID,VOL3,VOL6,WAVCFN,WCIINC,WEIGHT,WMIINC,WMIMUL,DI  2700
     1WLIINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI  2800
     14LIM,XIIL,XIIT,XKM,XKM3,XKML,XKMT,XLIDAM,XLAP,XLCR,XLCRIC,XLCR1,XLDI  2900
     1CF,XLCF3,XLCQ,XLCQIW,XLCQS,XLMBIM,XLMBDA,XMID,XMOMIL,XMOM3V,XMTI,YDI  3000
     1,Y1,YIMA,Z,WAVLOC ,X1DAM6,X2DAM6,XLMAPR,IAMAL                     DI  3100
      COMMON/4/ICAT,YIINT,NJMBEL,THETJM,LIMIT                           DI  3200
      DIMENSION  XIS(10),YIS(30,29),ZIS(30,99),YIST(2,29),ZIST(2,29),   DI  3300
     1ZINT(4,10),YINT(4,10),XBLK(4),NINT(4),NPIS(30),JBPIS(30,10),      DI  3400
     2JBPST(2,10),NPIST(2)                                              DI  3500
      COMMON XIS,YIS,ZIS,XBLK,YINT,ZINT,NPIS,NINT,YIS1,ZIST,NPIST,JBPIS,DI  3600
     1JBPST,INDXJ,JSTAT,KSTAT,LSTAT,MSTAT,NBULK,LBULK,JCAT              DI  3700
      NPT=NP(KSTAT)                                                     ST  3800
      NPIS(JSTAT) = NPT                                                 ST  3900
      DO 10  I=1,NPT                                                    ST  4000
      YIS(JSTAT,I)=Y(KSTAT,I)                                           ST  4100
10    ZIS(JSTAT,I) = Z(KSTAT,I)                                         ST  4200
      DO 20 I = 1,10                                                    ST  4300
20    JBPIS(JSTAT,I)=JBREAK(KSTAT,I)                                    ST  4400
      RETURN                                                            ST  4500
      END                                                               ST  4600
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      SUBROUTINE STRNTH                                                 ST   400
C                                                                       ST   300
      DIMENSION BMOM(25)                                                ST   400
      DIMENSION SHEAR(25)                                               ST   500
      DIMENSIONAIWP3(20),AMEAIS(60,2),AMFA2S(60),AMFA4S(20,10),BML(20),DI   600
     1BMT(20),CIALPH(20),CIP(60),CIWP(20),CIOUPT(20),DATE(2),DISPL3(20),DI   700
     1DWL(20),H(60),HICOMP(20),HIHOD(60),HIMAH(60),HIOUT(20),HISAO(60),HDI   800
     12COMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),NDI   900
     1AME1S(8),NCOMP3(2,3,3),NP(60),PERM(10),PERM1(3)                   DI   000
      DIMENSIONPERM2(10),MASID(6,10),S(60,29),SPS(60),SIGMIP(20),STATNO(DI  100
     160),SPCTIM(25),TCBIC(25),TCHS(5,5,10),TCOIP(60,20),TCO2S(60),THETSDI  200
     1M(10),TPI(20),TRIM3(6),VCBIC(25),VCHS(5,5,10),VCOIS(60,20),VCO2S(6DI  300
     10),VOL3(20),VOLS(5),VOLIC(25),WEIGHT(25),X(60),XIDAM(10),XIDAM2(1DI  400
     1),XIDAM3(20),X2DAM3(20),XIW(25),X2DAM(10),X2DAM2(10)              DI  500
      DIMENSIONX23(60),XKM3(20),XKML(20),XKMT(20),XLIDAM(30,3),XLCBIC(25DI  600
     1),XLCB3(20),XLCF3(20),XLCOIW(25),XLCOS(5),XMTI(20),Y(60,29),YI(60)DI  700
     1,Z(60,29),YINT(6,30),THETSM(5)                                    DI  800
      DIMENSION XLVR(25)                                                DI  900
      COMMON/1/AIMA,AIWP,AIWP3,AMEAIS,AMFA2S,AMFA4S,BML,BMT,CIA,CIALPH,CDI 1000
     1IN,CIC,CIP,CIOUPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIMAHC,HICOMPDI 1100
     1,HSCOMP,HIHOD,HIMAH,HIOUT,HISAO,HSMAH,HSMAH,HSMAH,HWI,IIAPT,IIBAL,DI 1200
     1II,IWD,IIBYM,IIWC,IIWH,IIWL,I2WC,I2WM,I2WL,IBREAK,ICOMP,ICHECK,INITDI 1300
     1,ISENTL,ISFRNO,ISTAT,ISTOP,ITEST1,ITEST3,IY,JBREAK                DI 1400
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIRLIT,NIOSPL,NISKEL,NILCGDI 1500
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSDI 1600
     1TAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAS,S,SIGMIP,SPS,SIGMIDI 1700
     1P,SPACE,STATNO,SECTIM,TCB,TCBIC,TCHS,TCOIS,TCO2S,THPTIM,THETIT,THEDI 1800
     1TST,THETSM,TPI,TRIM3,VCBIC,VCHS,VCOIS,VCO2S,VOL                   DI 1900
      COMMON/3/VOLIC,VOLID,VOL3,VOLS,WAVCEN,WCLINC,WEIGHT,WHLINC,WHIMUL,DI 2000
     1WLLINC,X,XIDAM,XIDAM2,XILIM,XLIM,XIW,X2DAM,X2DAM2,X2LIM,X23,X3LIM,XDI 2100
     1SLIM,XTIL,XTIT,XKM,XKM3,XKML,XKMT,XLIDAM,XLHP,XLCB,XLCBIC,XLCB3,XLDI 2200
     1CF,XLCF3,XLCO,XLCOIW,XLCOS,XLMBIH,XLMBDA,XMID,XMOMIL,XMOMJV,XMTI,YDI 2300
     1,YI,YIMA,ZWAVLOC,X1DAM3,X2DAM3,XLMBDH,IANAL                       DI 2400
      COMMON/4/ICAT,VLINT,NSHEEL,THETSM,LIMIT                           DI 2500
7321  FORMAT( 80H) THE FOLLOWING PAGES CONTAIN THE RESULTS OF LONGITUDINST 2600
     1AL STRENGTH CALCULATIONS./  40    H THIS IS AN OUTPUT OF SUBROUTINEST 2700
     2 STRNTH.  //22 H UNITS AND DEFINITIONS      //                    ST 2800
     320 H BENDING MOMENT     FT TONS        /                          ST 2900
     420 H BUOYANCY           LONG TONS      /                          ST 3000
     531 H LOCATION           FEET FROM FP   )                          ST 3100
7322  FORMAT(                                                           ST 3200
     1404 SECTION MODULUS   BENDING MOMENT/STRESS /                     ST 3300
     220 H WEIGHT             LONG TONS      /                          ST 3400
     3      74 H FOR DEFINITIONS OF WT ORD,BUOY ORD,SHEAR ORD,AND MOM ORST 3500
     4RD, SEE DDS 2900-1      )                                         ST 3600
      WRITE (6,806)(NAME(I), I = 1,8), ISFRNO,(DATE(I), I = 1,2)        ST 3700
      WRITE (6,7321)                                                    ST 3800
      WRITE (6,7322)                                                    ST 3900
      WTS = 0.0                                                         ST 4000
      ICHECK = 1                                                        ST 4100
      IF(ABS(X(1)-XIW(1))-.1) 301,301,302                               ST 4200
  301 ICHECK = 2                                                        ST 4300
  302 XMOMIL = 0.0                                                      ST 4400
      DO 600 I = 1,NSTAT4                                               ST 4500
      WTS = WTS + WEIGHT(I)                                             ST 4600
  600 XMOMIL = XMOMIL + WEIGHT(I)*XLCOIW(I)                             ST 4700
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      XLCG9 = XLCG                                                      ST  5700
      XLCG = XMOMBL/WTB                                                 ST  5800
  600 FORMAT(38H SHIP BALANCED USING LCG AS CALCULATED FROM WEIGHT INPUTST  5900
     1 WHICH IS F6.2,                                                   ST  6000
     2 28HFT FROM AMIDSHIPS (+ FWD) )                                   ST  6100
  806 FORMAT(6H1SHIP-4A8A6,5X16HSERIAL NUMBER-I4,5X8HDATE-2A6/)         ST  6200
      VOLID9 = VOLID                                                    ST  6300
      VOLID = WTB*35.0                                                  ST  6400
      IF(IWC-1) 130,130,98                                              ST  6500
   98 KW=3                                                              ST  6600
      GO TO 99                                                          ST  6700
  130 KW=2                                                              ST  6800
      GO TO 99                                                          ST  6900
 1834 KW = 1                                                            ST  7000
      IIWL=1                                                            ST  7100
      IIWH=1                                                            ST  7200
      IIWC=1                                                            ST  7300
   99 DO 140 I2WC = 1,IIWC                                              ST  7400
      DO 130 I2WL = 1,IIWL                                              ST  7500
      DO 130 I2WH = 1,IIWH                                              ST  7600
      CALL WAVE                                                         ST  7700
      KVOL=1                                                            ST  7800
      IIWAL=1                                                           ST  7900
      CALL WAL                                                          ST  8000
      XIW(NSTATA)=X(NSTAT)                                              ST  8100
    7 IF (ABS(X(NSTAT) - XIW(NSTATA - 1))- .1) 9,9,7087                 ST  8200
 7087 IF(X(NSTAT)-XIW(NSTATA-1))    9,9,11                             ST  8300
    9 NSTATA=NSTATA-1                                                   ST  8400
   11 CONTINUE                                                          ST  8500
C                                                                       ST  8600
      VOL1=0.0                                                          ST  8700
      WT1=0.0                                                           ST  8800
      XLCG1=0.0                                                         ST  8900
      FACTR1=1000.0/VOL                                                 ST  9000
      FACTR2=200.0/(WLWP*VOL/35.0)                                      ST  9100
      FACTR3=100.0*WP/VOLID                                             ST  9200
      KVOL=1                                                            ST  9300
      CALL VOLUME                                                       ST  9400
      WRITE (6,806)(NAME(I), I = 1,8), ISERNO,(DATE(I), I = 1,2)        ST  9500
      GO TO (1838,1836,109),KW                                          ST  9600
  109 WRITE (6,111)                                                     ST  9700
  111 FORMAT(/  1H ,                                                    ST  9800
     1           34HLONGITUDINAL STRENGTH CALCULATIONS  ,   10H        ST  9900
     2  ,     10H HOGGING CONDITION  )                                  ST 10000
      GO TO 113                                                         ST 10100
 1838 WRITE (6,1836)                                                    ST 10200
 1836 FORMAT(/  1H ,                                                    ST 10300
     1           34HLONGITUDINAL STRENGTH CALCULATIONS  ,   10H        ST 10400
     2  ,     13H STILL WATER )                                         ST 10500
      GO TO 115                                                         ST 10600
  114 WRITE (6,112)                                                     ST 10700
  112 FORMAT(/  1H ,                                                    ST 10800
     1           34HLONGITUDINAL STRENGTH CALCULATIONS  ,   10H        ST 10900
     2  ,     13H SAGGING CONDITION  )                                  ST 11000
  113 IF(HW1)    16,16,17                                               ST 11100
   16 WRITE (6,8)WHIMUL,WAVLOC,XLMRPR                                   ST 11200
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 8    FORMAT(1H0,                                                          ST 11300
     1       23HWAVE HT.=1.1*SQRT(LBP),2H=(,F8.2,    1H),8X       ,       ST 11400
     2         13HWAVE CENTER=,F8.2,                                      ST 11500
     3 25HFT FROM AMIDSHIPS (+ FWD) ,8X,17HWAVE LENGTH/XLBP=,F8.3)        ST 11600
      GO TO 19                                                            ST 11700
 17   WRITE (6,18)WHTMUL,WAVLOC,XLMR2R                                    ST 11800
 18   FORMAT(1H0,                                                         ST 11900
     1       17HWAVE HT.=LBP/20.0       ,2H=(,F8.2,    1H),8X       ,    ST 12000
     2         18HWAVE CENTER=,F8.2,                                      ST 12100
     3 25HFT FROM AMIDSHIPS (+ FWD) ,8X,17HWAVE LENGTH/XLBP=,F8.3)        ST 12200
 19   CONTINUE                                                            ST 12300
C                                                                        ST 12400
      WRITE (6,800)XLCG                                                  ST 12500
 991  CONTINUE                                                            ST 12600
C                                                                        ST 12700
      WRITE (6,3)                                                        ST 12800
 3    FORMAT(1H0,10H  LOCATION,                                           ST 12900
     110H     WEIGHT  ,                                                  ST 13000
     210H       BUOY  ,                                                  ST 13100
     315H          SHEAR  ,                                            ST 13200
     419H BENDING MOMENT   ,                                            ST 13300
     510H   WT. ORD   ,                                                 ST 13400
     610H  BUOY ORD   ,                                                 ST 13500
     710H SHEAR ORD   ,                                                 ST 13600
     810H   MOM ORD   ,                                                 ST 13700
     918H           STRESS     / )                                      ST 13800
C                                                                        ST 13900
 6    ZERO=0.0                                                           ST 14000
      WRITE (6,5)X(1), ZERO,ZERO,ZERO,ZERO                               ST 14100
 5    FORMAT(1H ,F10.3,20X,                                              ST 14200
     1 2F10.3,20X,2F10.3,F10.3)                                          ST 14300
C                                                                        ST 14400
   88 DO 1 I = ICHECK,NSTAT                                              ST 14500
      IF(I-1)1990,1990,1991                                              ST 14600
1990  FACTR4 = X1W(I) - X(I)                                             ST 14700
      GO TO 1992                                                         ST 14800
1991  FACTR4 = X1W(I)-X1W(I-1)                                           ST 14900
1992  IF (ABS(WT) * WEIGHT(I)= .00001) 86,86,87                          ST 15000
 86   XLCG1=XLCG1W(I)                                                    ST 15100
      GO TO 89                                                           ST 15200
 87   XLCG1=(WT1*XLCG1+WEIGHT(I)*XLCG1W(I))/(WT1+WEIGHT(I))              ST 15300
 89   WT1=WT1+WEIGHT(I)                                                  ST 15400
      XLCG2=X1W(I)-(X(I)FWD)*XLBP/2.0-XLCG1)                             ST 15500
      XLCG2=X1W(I)-XLCG1C(I)                                             ST 15600
      SHEAR= WT1-VOL1C(I) /39.0                                          ST 15700
      SHEAR1(I)=FACTR1*SHEAR                                             ST 15800
      AMOM(I)=WT1*XLCG2-VOL1C(I)*XLCR2/39.0                              ST 15900
      AMOM=AMOM(I)*FACTR2                                                ST 16000
      VOL2=(VOL1C(I)-VOL1)/39.0                                          ST 16100
      VOL1=VOL1C(I)                                                      ST 16200
      VOLA = FACTR3*VOL2/FACTR4                                          ST 16300
      WT1ORD = FACTR4*WEIGHT(I)/FACTR4                                   ST 16400
      IF (ABS(SECTIM(I))= .000001) 869,869,869                           ST 16500
 869  STRESS=AMOM(I)/SECTIM(I)                                           ST 16600
      WRITE (6,888)WEIGHT(I), VOL2, WT1ORD, VOLA, X1W(I),SHEAR,AMOM(I),SHT 16700
     1HEAR1(I), AMOM,STRESS                                              ST 16800
```

```
 888 FORMAT(1H 10X,F10.3,30X,F10.2/1H F10.3,20X,F10.3,20X,F10.3,F10.3)  ST 16900
     GO TO 1                                                           ST 17000
 863 WRITE (6,888)WT(OM(I), VOL2, WTLOAD, VOLA, XLW(I), SHEAR, BMOM(I) ST 17100
    1, SHEAR(I), XMOM                                                  ST 17200
   1  CONTINUE                                                         ST 17300
 864 VOL1=VOL1/38.0                                                    ST 17400
     WRITE (6,143)WT1,VOL1                                            ST 17500
 143 FORMAT(/ 2H TOTALS          4X,F10.3)                            ST 17600
     NSTATB = 2                                                       ST 17700
     NSTATB = NSTATB-1                                                ST 17800
 910 DO 700 I = NSTATM,NSTATN                                         ST 17900
     IF (ABS(SHEAR(I))- .00001) 702,702,701                           ST 18000
 701 IF (ABS(ABS(SHEAR(I)) - ABS(SHEAR(I - 1)) - ABS(SHEAR(I) + SHEAR ST 18100
    1(I + 1))- .000001 ) 700,700,703                                  ST 18200
 700 CONTINUE                                                         ST 18300
     GO TO 138                                                        ST 18400
 703 XMOM=XLW(I)*(XLW(I+1)-XLW(I))* ABS(SHEAR(I))/ABS(SHEAR(I)-SHEARST 18500
    1(I+1))                                                           ST 18600
  70 CALLCOEF1(XLW(I-1),XLW(I),XLW(I+1),XMOM)                         ST 18700
     BMOMB=PINTP2(BMOM(I),BMOM(I+1),BMOM(I-1))                        ST 18800
     GO TO 707                                                        ST 18900
 702 BMOMB=BMOM(I)                                                    ST 19000
     XMOM=XLW(I)                                                      ST 19100
 707 WRITE (6,708)BMOMB,XMOM                                          ST 19200
 708 FORMAT(//22H MOMENT AT ZERO SHEAR=,F10.3,10H LOCATED ,F10.3,     ST 19300
    126H FT FROM FWD PERPINDICULAR)                                   ST 19400
     NSTATB = I+1                                                     ST 19500
     IF(NSTATB-NSTATN)910,138,138                                     ST 19600
 138 CONTINUE                                                         ST 19700
     GO TO (137,98,1234),KW                                           ST 19800
 137 XLCG = XLCGB                                                     ST 19900
     RETURN                                                           ST 20000
     END                                                              ST 20100
```

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      SUBROUTINE TABLE                                                  TA   200
      DIMENSION AWP1(20),AREA1S(60,20),ARPA2S(60),AREA4S(20,10),BML(20),DI   300
     1BMT(20),CIALPH(20),CIP(20),CIWP(20),CIDOPT(20),DATE(2),DISPL3(20),DI   300
     1DWL(20),H(60),HICOMP(20),HIMOD(60),HIMAR(60),HIOUT(20),HISAD(60),HD   400
     1ECOMP(20),ICOMP(2),JBREAK(60,10),JMAX(3),KMAX(2,3),KP(8),NAME(8),ND   500
     1AME1S(8),NCOMP3(2,3,3),NP(60),PERM1(8),PERM1(3)                   DI   600
      DIMENSION PERM2(8),RAS(5,5,10),S(60,20),S2S(60),S3SHIP(20),STATNO(DI   700
     160),SECTIM(20),TCRIC(20),TCRS(5,5,10),TCQ1S(60,20),TCQ2S(60),THETSDI   800
     1M(10),TPI(20),TRIM3(6),VCRIC(20),VCRS(5,5,10),VCQ1S(60,20),VCQ2S(6DI   900
     10),VOL1S(20),VOL2S(8),VOLIC(20),WEIGHT(20),X(60),XIDAM(10),XIDAM2(10DI  1000
     1),XIDAM3(20),X2DAM3(20),XIW(20),X2DAM(20),X2DAM2(10)              DI  1100
      DIMENSION XKP3(60),XKR3(20),XKRL(20),XKRT(20),XL1DAM(30,3),XLCB1C(20DI  1200
     1),XLCR3(20),XLCP3(20),XLCQ1W(20),XLCQ3(8),XMT1(20),Y(60,20),Y1(60)DI  1300
     1,Z(60,20),Y1INT(4,30),THETSM(8)                                   DI  1400
      DIMENSION XLVM(20)                                                DI  1490
      COMMON/1/AIMA,AIWP,AIWP3,AREA1S,AREA2S,ARPA4S,BML,BMT,CIA,CIALPH,CDI  1500
     11B,CIC,CIP,CIDOPT,CIWP,CONST,DATE,DISPL,DISPL3,DWL,H,HIMADC,HICOMPDI  1600
     1,HPCOMP,HIMOD,HIMAR,HIOUT,HISAD,HPMAR,HAMAR,HWL,IIAFT,IIMAL,IDI  1700
     1I1FWD,I1SYM,I1WC,I1WM,I1WL,I2WC,I2WM,I2WL,IBREAK,ICOMP,ICHECK,INITDI  1800
     1,IRENT1,ISEMNO,ISTAT,ISTOP,ITEST1,ITEST2,IY,JBREAK                DI  1900
      COMMON/2/JMAX,K,KK,KMAX,KP,KVOL,KW,M,MA,NIBUTT,NIDSPL,NIHEEL,NILCGDI  2000
     1,NIPERM,NITRIM,NAME,NAME1S,NCOMP1,NCOMP2,NNSTAT,NP,NSTAT,NSTAT1,NSCI  2100
     1STAT2,NSTAT3,NSTAT4,NWL,NWP,PERM,PERM1,PERM2,RAS,S,S1SHIP,S2S,S3SHIDI  2200
     1P,SPACE,STATNO,SECTIM,TCR,TCRIC,TCRS,TCQ1S,TCQ2S,THETIM,THETIT,THEDI  2300
     1TAT,THETSM,TPI,TRIM3,VCBIC,VCRS,VCQ1S,VCQ2S,VOL                   DI  2400
      COMMON/3/VOL1C,VOL1D,VOL3,VOL4,WAVCRN,WCLINC,WEIGHT,WWLINC,WWLMUL,DI  2500
     1WLLINC,X,XIDAM,XIDAM2,XILIM,XIM,XIW,X2DAM,X2DAM2,X2LIM,X2S,X3LIM,XDI  2600
     14LIM,XILL,XILT,XKR,XKR3,XKRL,XKRT,XL1DAM,XLCP,XLCR,XLCB1C,XLCR3,XLDI  2700
     1CP,XLCP3,XLCQ,XLCQ1W,XLCQ3,XLMBIM,XLMBDA,XMID,XMOMIV,XMOMJV,XMTI,YDI  2800
     1,Y1,Y1MA,Z,WAVLOC,XIDAM3,X2DAM3,XLMBDR,IABAL                      DI  2900
      COMMON/4/ICAT,Y1INT,NSHEEL,THETSM,LIMIT                           DI  3000
C                                 LOGIC SECTION 1                       TA  3100
      DO 10  ISTAT = 1,LIMIT                                            TA  3200
C                                 LOGIC SECTION 2                       TA  3300
      XMOMIV = 0.0                                                      TA  3400
      XMOMIT = 0.0                                                      TA  3500
      NPOINT=NP(ISTAT)-1                                                TA  3600
      AREA1S(ISTAT,1)=0.0                                               TA  3700
      S(ISTAT,1) = Y(ISTAT,1)                                           TA  3800
      VCQ1S(ISTAT,1) = Z(ISTAT,1)                                       TA  3900
      TCQ1S(ISTAT,1)=Y(ISTAT,1)/2.0                                     TA  4000
      IBREAK = 2                                                        TA  4100
C                                 LOGIC SECTION 3                       TA  4200
      DO 10 IY=1,NPOINT,2                                               TA  4300
C                                 LOGIC SECTION 4                       TA  4400
      IF(NPOINT)90,10,10                                                TA  4500
C                                 LOGIC SECTION 5                       TA  4600
   10 IF(IY + 1 -JBREAK(ISTAT,IBREAK))30,30,20                          TA  4700
C                                 LOGIC SECTION 6                       TA  4800
   30 IF(JBREAK(ISTAT,IBREAK)-JBREAK(ISTAT,IBREAK-1) - 1)40,30,40       TA  4900
C                                 LOGIC SECTION 7                       TA  5000
   20 IBREAK = IBREAK + 1                                               TA  5100
      GO TO 10                                                          TA  5200
C                                 LOGIC SECTION 8A                      TA  5300
   40 ITEST1 = -1                                                       TA  5400
      M = IY                                                            TA  5500
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      GO TO 90                                                          TA  9800
C                                 LOGIC SECTION 8B                      TA  9900
   10 M=IY                                                              TA  6000
      ITEST1=0                                                          TA  6100
      GO TO 90                                                          TA  6200
C                                 LOGIC SECTION 8C                      TA  6300
   40 M=IY-1                                                            TA  6400
      ITEST1=1                                                          TA  6500
   90 CALL CORFIC                                                       TA  6600
C                                 LOGIC SECTION 9                       TA  6700
      CALL WETSRP                                                       TA  6800
C                                 LOGIC SECTION 10                      TA  6900
      MM=IY                                                             TA  7000
      MMM=IY+1                                                          TA  7100
      ITEST1=0                                                          TA  7200
      SPACE=(Z(ISTAT,MMM)-Z(ISTAT,MM))/2.0                              TA  7300
      ZIM=Z(ISTAT,MM)+SPACE                                             TA  7400
      YIM=FINTP1(ZIM,C1A,C1B,C1C)                                       TA  7500
C                                 LOGIC SECTION 11                      TA  7600
   70 AREAIS(ISTAT,MMM) = FINIG(Y(ISTAT,MM),YIM,Y(ISTAT,MMM),SPACE*2.0/TA  7700
     13.0) + AREAIS(ISTAT,MM)                                           TA  7800
      IF(AREAIS(ISTAT,MMM))72,72,71                                     TA  7900
   72 TCOIS(ISTAT,MMM) = 0.0                                            TA  8000
      AREAIS(ISTAT,MMM) = 0.0                                           TA  8100
      VCOIS(ISTAT,MMM) = 0.0                                            TA  8200
      GO TO 69                                                          TA  8300
   71 TCOIS(ISTAT,MMM) = (FINIG(Y(ISTAT,MM)**2,YIM**2,Y(ISTAT,MMM)**2,  TA  8400
     1SPACE/3.0) + AREAIS(ISTAT,MM)*TCOIS(ISTAT,MM))/AREAIS(ISTAT,MMM)  TA  8500
      VCOIS(ISTAT,MMM) = (FINIG(Y(ISTAT,MM)*Z(ISTAT,MM),YIM*ZIM,Y(ISTATTA  8600
     1,MMM)*Z(ISTAT,MMM),SPACE*2.0/3.0) + AREAIS(ISTAT,MM)*VCOIS(ISTATMTA  8700
     2M))/AREAIS(ISTAT,MMM)                                             TA  8800
C                                 LOGIC SECTION 12                      TA  8900
   69 IF(ITEST1)90,60,10                                                TA  9000
C                                 LOGIC SECTION 13                      TA  9100
   60 ITEST1=1                                                          TA  9200
      MMM = IY + 2                                                      TA  9300
      YIM=Y(ISTAT,IY+1)                                                 TA  9400
      ZIM= Z(ISTAT,IY+1)                                                TA  9500
      SPACE = ZIM-Z(ISTAT,MM)                                           TA  9600
      GO TO 70                                                          TA  9700
C                                 LOGIC SECTION 14                      TA  9800
   10 CONTINUE                                                          TA  9900
      RETURN                                                            TA 10000
C                                 LOGIC SECTION 15                      TA 10100
   99 STOP 33333                                                        TA 10200
      END                                                               TA 10300
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Unclassified

None

Damage Stability System for the Ship Hull Characteristics Program

None

None

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222

None

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None

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None

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The Damage Stability system for the Ship Hull Characteristics Program (SHCP) consists of two major supervisor programs.

A. Subroutine CMPRMNT - this program supervises the generation of compartment offsets for the compartment bulkheads and all intermediate ship stations that lie within the bounds of the compartment, based on an outline description of each bulkhead. A Compartment Data Table (CDT), similar in form to the Ship Data Table (SDT), of offsets, sectional areas, centers of area, and breadpoint, is then created and stored on the Ship Data Tape (SDTT) for later recall by Subroutine DAMAGE.

B. Subroutine DAMAGE - this program supervises the calculation of damage stability characteristics of the ship minus selected flooded compartments for a range of draft, trim, and heel conditions. The sequence of events for each condition of compartments, draft, trim, and heel is as follows:

1. The SDT is read from the SDTT.
2. The volumetric properties of the intact ship are calculated.
3. For each selected compartment, the associated CDT is read from the SDTT and the volumetric properties of the compartment are calculated and stored.
4. The net volumetric properties and the righting arm for the ship minus compartments, i.e., the flooded condition, is computed and output for the condition is printed out.

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
DAMAGE STABILITY						
SHIPS						
HULL						
COMPUTER PROGRAM						
SHIP DESIGN						